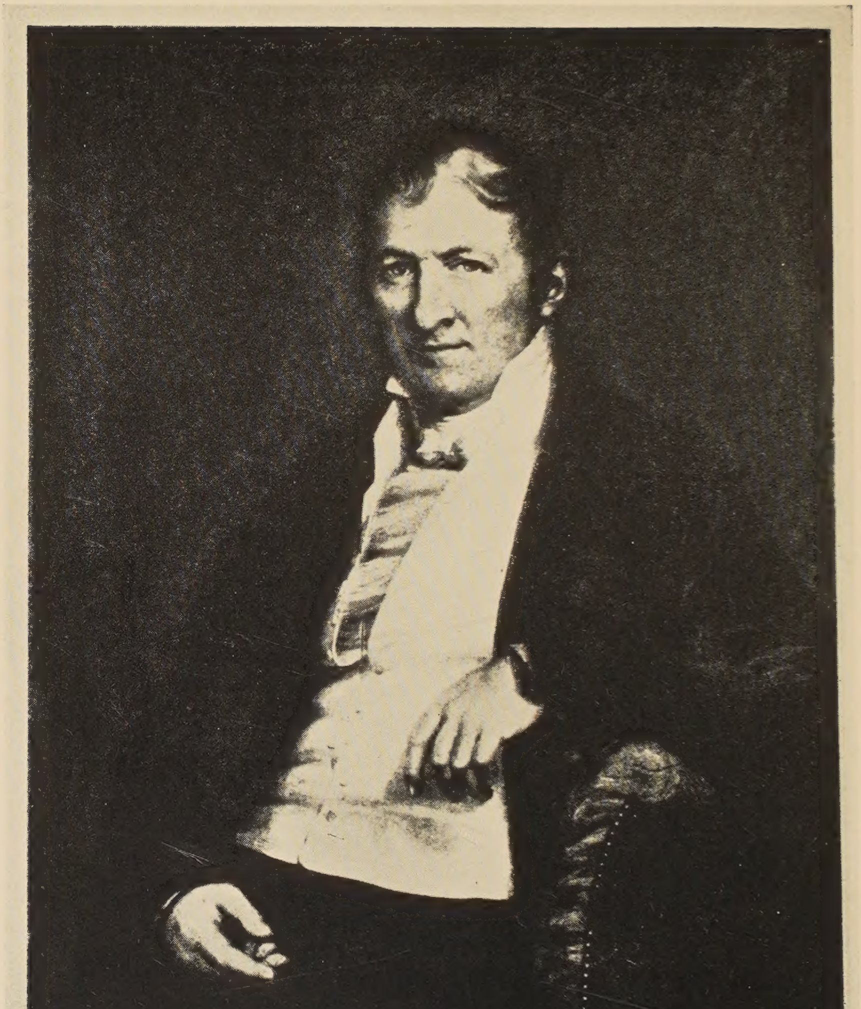
SIGILLUM REIPUBLICÆ CONNECTICUTENSIS

QUI TRANSTULIT SUSTINET

BC

HISTORY OF CONNECTICUT



ELI WHITNEY, 1765–1823
Inventor of the Cotton Gin and Developer of the Modern System of Quantity Production and Interchangeable Parts Through Division of Labor.

History of Connecticut

In Monographic Form

NORRIS GALPIN OSBORN
EDITOR

VOLUME FOUR

THE STATES HISTORY COMPANY
NEW YORK
1925

Publication Office
156 Fifth Avenue, New York, N.Y.
U. S. A.

PREFACE

This volume of the series of five comprised in the complete work is the first attempt to present a connected story of the marvellous growth of manufacturing Connecticut from Colonial days to the present time. As such, it possesses the defects—and, it is hoped, certain of the virtues—inseparable from any pioneer work. It aims to be what its title purports—an "industrial history." In this, it differs radically from a certain type of publication, not unfamiliar to most persons or institutions of standing, in which a more or less laudatory biographical or historical narrative may be secured for a consideration. In preparing the text, the author has been wholly untrammeled in this respect. He has, however, to acknowledge his obligation to hundreds of manufacturers of the State who have furnished historical matter pertaining to their respective concerns or their industrial groups. Indeed, this source has been distinctly more valuable than the authorities named in the bibliography. Much of it is new matter hitherto unpublished.

There has been no rule of thumb to govern the space allotted to various individual firms or classes of industry. An attempt has been made to appraise the facts submitted at their true historical value, or in accordance with their measure of human interest. The accounts of the founding and growth of certain companies or industries may seem disproportionately long. In the case of other concerns of corresponding magnitude, the narrative may seem to have been unduly curtailed. It is hoped, however, that where the accounts have been full

there will be recognized as running through them a vein of particular historical value. In other instances, where the historical element appears less pronounced, the firms have been selected for fuller treatment because they typified, in some peculiar aspect, modern industrial methods as they have been worked out within the State. In still other instances, unfortunately, the failure of the officers of companies to comply with the author's request for satisfactory histories of their respective concerns has necessitated brevity. Numerous relatively important firms have, of course, received no individual mention because of the limitations of space. This volume does not presume to be a gazetteer of Connecticut manufactories. That is available in the "List of Connecticut Manufacturers and Their Products," compiled by the Factory Inspection Department of Connecticut; also in various other publications privately issued.

In addition to his appreciation of the general assistance received from the officers and salaried employees of Connecticut industrial corporations, the author wishes to acknowledge certain particular obligations. Foremost among these is his profound debt—deepened in this case by parental pride and affection—to Ruth Chandler Moore, who has painstakingly performed the arduous work of studying sources, sifting and assembling data, and preparing the basic text of large parts of the book. Without her assistance the completion of this work would have been found impossible in the light of other demands, and it would be more just that the title page show a joint authorship of this volume by Mrs. Moore and the person to whom it is formally accredited.

The chapter on "Machine Tools" is in the main contributed by Mr. E. P. Blanchard, whose educational

background and technical knowledge of this specialized department of industry was made available through his courtesy. The article is not formally accredited to him because the author took certain liberties with it, in order to make it conform to the other chapters and the general scheme of the book.

Appreciation is also expressed to Mr. A. C. Hickmott, who made a study of the power problem and submitted valuable data in such excellent literary form that portions of it have been quoted direct in the chapter on "Power—Its Production, Transmission and Use."

Mr. Loyd L. Anderson has also rendered the author valuable assistance in checking the rough draft for instances of duplication, overlapping and illogical sequence.

The special articles at the end of the volume on "Transportation" and the "Oyster Industry of Connecticut" are signed, and require no acknowledgment in this place.

Mr. Clark Belden prepared the chapter entitled "Summary of Connecticut Industries" and also assisted the author in gathering, preparing and checking certain other material.

The author has also been especially favored by access to the physical and clerical facilities and wide range of industrial contacts made available to him by his official connection with the Connecticut Chamber of Commerce. Appreciation should be particularly expressed for the consideration shown him by Mr. Stanley H. Bullard, president of that organization, for four and one-half years, who has been so kind as to characterize the completion of a work of this kind as a direct service to Connecticut business.

Connecticut is an industrial prodigy. The romance, tragedy, pathos, humor and glory of its development from the habitat of petty household industries, patiently and arduously carried on in kitchens, barns and dooryards, to the present swarming hive of huge, modern manufacturing plants covering acres of ground and employing tens of thousands of people, present one of the most dramatic and informing chapters of modern history. When one views the little rectangle, wedged between Massachusetts and Long Island Sound, a mere speck upon the map of the United States, and learns from the following pages the amazing number of industries and inventions, born within its borders, which have been revolutionary in their scope and ministered incalculably to the happiness and well-being of mankind, he feels like exclaiming, as did Morse when he sent his first telegram over the wires, "What Hath God Wrought!"

George B. Chandler,

Hartford, Connecticut, *May* 16, 1925.

CONTENTS

INDUSTRIAL HISTORY

TRANSPORTATION

ILLUSTRATIONS

INDUSTRIAL HISTORY

By George B. Chandler

Born Fryeburg, Me., October 21, 1865; son of James Everett and Henrietta N. (Sanborn) C.; A.B., Bowdoin, 1890; married Mabel Ayers of St. Louis, June 5th, 1895. Principal High schools, Franklin and Milford, Mass., successively, 1890–1891 and 1891–1892; associated with Ginn and Company, Boston, 1892–1905, American Book Company, New York, 1905–1916. Speaker in national, State and local campaigns since 1896; member Connecticut House of Representatives, sessions 1909 and 1911, (chairman committees on railroads, labor, special investigating commission); specialized on social and industrial problems; appointed by President Taft 1912 member National Commission on Industrial Relations; appointed Compensation Commissioner of the First Congressional District of Connecticut, October 1, 1913; president Hartford Get-Together Club, 1910–1911. Republican. Congregationalist. Member Theta Delta Chi. Clubs: University (Hartford), Graduates' (New Haven). Lecturer before civic, educational and industrial societies; contributor to periodicals; chairman committee on publicity, Connecticut State Council of Defense, May 1917–November 12, 1918; member, Military Census Commission State of Connecticut, March–May, 1917. Chairman, Chambers of Commerce Committee, New England Shippers' Advisory Board. Executive vice-president, Connecticut Chamber of Commerce, January 1, 1919. Home, Rocky Hill, Connecticut; office, 3 Lewis Street, Hartford, Conn.

The Foundations of Connecticut Business

WHEN the Connecticut delegates to the federal Constitutional Convention of 1787 announced that they represented a manufacturing State, their statement was inspired by ardent hope or the spirit of prophecy, rather than any basis of accomplished fact.

In order to present a true picture of the marvellous fulfillment of that prophecy, it is necessary to sketch those broad foundations, grounded in sound business habit, and nurtured by indomitable courage, which have shaped the character of the State. Especially must it be shown how business training, manual skill, and the amassing of surplus capital for productive enterprise had their beginnings. For these reasons the early business ventures of the people, particularly those related to the shipping interests, are outlined.

Until the nineteenth century definitely closed the Colonial Era, Connecticut was a straggling colony of agricultural and shipping settlements, dotted here and there, especially in Litchfield County, by a few mines with their surrounding forges or iron works, and in the inland villages by an occasional "manufactory,"—a clock or tin shop, a paper mill or mill for fulling woolen cloth. All were on a pitiably small scale, except the manufacture of tinware and "Yankee Notions" for peddling, which was growing up rapidly in and around Berlin and like the theme of an opera underlies the great romance of Connecticut metal industry.

The early settlers were shrewd Puritans with the hardheaded characteristics which lead Bradford to call

them "muskeeto-proof." They embraced, with peculiar adaptability, whatever opportunities the new country offered them. The first comers, settling along the broad Connecticut River, nature's highway from Massachusetts to the Sound, turned to agriculture, tilling the rich river land and at a relatively early date establishing profitable tobacco culture. The settlers in less fertile districts soon learned to eke out their livelihood making small objects, mainly hardware, which could be sold throughout the neighboring colonies; and, later on, the fortunate settlers who had followed the river to the sea and spread along the coast turned to maritime pursuits.

It was only as a shipping colony that Connecticut then enjoyed distinction, but from the ownership of sailing vessels, singly and in fleets, and the exchange of produce on a relatively large scale, the early inhabitants learned how to carry on businesses of considerable magnitude. They acquired the habit of investing capital in large sums, managing it with foresight, and taking profits and losses as the fates decreed. Indeed, we may call shipping the Training School of Connecticut business. As will be seen, shipping as a commercial enterprise logically developed, in the course of time, into shipbuilding as an important industry. Doubtless the first venture of this sort was the ill-fated vessel of 100 tons built by the first New Haven settlers and laden for England with the best part of their commercial wealth, in the hope of retrieving certain financial losses sustained in planting the Colony. She was ready in mid-winter and, that no time might be lost, the ice in the harbor was broken for her to set sail January, 1647. She was never again heard from. Although this disaster so discouraged the colonists that at one time they contemplated

abandoning the settlement, both the town and the shipping remained to prosper.

From the first, the shipping was mainly with the West Indies, and coastwise to colonial ports, notably Charleston. The very same year that the unfortunate New Haven ship was lost, another was sent to the Barbadoes with a cargo of salted beef in exchange for sugar. New London, Norwich, Milford, and other coast settlements, and even Hartford, half way up the river, soon followed suit. By 1753 there were eight recognized ports, although it is said that all masters entered and cleared through New London. Hartford merchants, being at considerable disadvantage on account of remoteness from a harbor and the necessity of maintaining agency offices in New Haven, dealt only in rum and molasses with the West Indies.

In those days New Haven was the leader—although later New London supplanted her—with her famous Long Wharf, measuring 3,500 feet in length. The wharf was not actually finished until 1802, but was in active use many years before it was completed. Here was the headquarters for foreign trade, and few ships returned to New Haven without bringing some contribution of freight for the Wharf.

The period from 1782 to 1820 saw the zenith of Connecticut's career as a shipping center and "Commerce with her sister Industry Agriculture" was publicly extolled as the basis of the State's wealth and development. The Napoleonic Wars had diverted foreign competition and the Valley and Sound towns became centers of prosperous trade. Tonnage increased and profits were large, despite seizures and admiralty decisions. Connecticut schooners carried

cider, butter, cheese, tinware and clocks to the Southern ports. Other vessels of comparatively small burden carried to the West Indies grain, butter, salted meat and fish, vegetables, tobacco, cattle and lumber, bringing back cargoes of sugar, and molasses to be made into rum. A few vessels from New London and New Haven attempted transatlantic trips, but European shipping was usually carried on through the port of New York.

At about the opening of the nineteenth century came that greatest of Connecticut's maritime ventures, the "New Haven South Seas Fleet" of twenty vessels, owned by a New Haven Company and manned and officered by citizens of the town or neighboring communities. This enterprise flourished greatly for some years. Its main interest was the sealing off South America, where herds were abundant at that time. The skins were cured on the mainland and there was a tract of land several miles long in Pategonia known for many years as "New Haven Green" where the pelts were spread to dry. They were then carried around Cape Horn to China, where they were sold or exchanged for return cargoes of tea, silk and other valuable Oriental goods. Most renowned of the fleet was "The Neptune," which circumnavigated the globe in a three year trip, returning in triumph to the Long Wharf in 1799 with the richest cargo received up to that time. It consisted mainly of tea, silk and china and yielded a profit of $240,000, paying duties of $70,000.

In 1797 the Derby Fishing Company was formed with a capitalization of $200,000, raised by New Haven and Derby investors for the purpose of fishing off the banks of Newfoundland and to ply the European and West

Indies trade. The Company purchased several ships and enjoyed a period of brief prosperity, its failure being due rather to poor management, it is claimed, than the disaster which overtook all Connecticut shipping at about that time.

At this period, 1800 to 1812, there were few towns in the State which were not directly or indirectly dependent upon commerce. From New Haven and New London harbors an average of 100 foreign bound vessels left annually. Farmers were urged to plant more crops and raise more cattle for export. There was great rivalry between the ports of New London and New Haven and Norwich, but until the New London whaling era, which reached its height after the decline of the trading days, New Haven appears to have been the leader in trade, and New London in shipbuilding. That most ill-natured history of the Colony, published in London in 1701 by the sour Peters of false Blue Law fame, chronicles that "New Haven harbor is incommoded by flats near the town for a mile in width and by ice in the winter. The former evil is in some measure remedied by long expensive wharves, but that latter is incurable. The people, however, say their trade is greater than that of New London or Norwich, and the shipping of different burthens consists of nearly 200 sails."

The New London whaling fleets, previously referred to, also furnished an important shipping interest. It was also, in a sense, an industry. As a whaling center, this city was surpassed only by New Bedford, Massachusetts. Although these activities are contemporaneous with the development of manufacturing and may not, therefore, be classed as one of the "foundations" of

Connecticut business, it should be pointed out, as an example of the business resilience of the State, that after the disaster of the embargo and War of 1812 this city again took up whaling. "The Carrier" was the first vessel from New London to make a voyage for sperm whales. She was absent for nearly three years, returning with 2,074 barrels of oil. The height of the prosperity of this industry was reached in 1846, when New London boasted 78 sailing vessels engaged in whaling; but by the middle of the century the increasing scarcity of whales, the withdrawal of 19 vessels for California voyages on account of the gold craze, and the substitution of petroleum for sperm oil for purposes of illumination put an end to the New London whaling interests.

Out of these commercial activities, and indeed an indispensible concomitant of them, grew Connecticut's first large manufacturing enterprise—that of shipbuilding. In this New London was the leader. As early as 1662, John Winthrop, Jr., while in England as agent for the Colony, read a paper before the Royal Society, then just incorporated, on the advantage of the North American provinces for shipbuilding. This doubtless turned the attention of the British merchants to the New England harbors and gave the original impetus to one of the most profitable industries of the time. The first craft were, of course, small, built for coasting trade; but by 1700, colonists were already considering the construction of vessels for the West Indies trade. "Jeffrey's Great Ship" of 700 tons, the largest constructed up to that time in North America, was launched with public rejoicing in 1723 at New London.

Ships had been built on the deep and commodious New London harbor as early as 1660, the most famous of

the earlier craft being called "Mould's Vessels," from an especially competent builder. This industry reached its height at this natural point of vantage during the prominence of that city as a whaling port, and during the World War its facilities were again called into requisition on an extended scale, the United States Government still utilizing it as a submarine base.

As early as 1750, shipbuilding had become a fixed industry and British merchants were beginning to purchase New England-built vessels. Some two-or-three masted ships were built, their launchings being made public occasions. A Glastonbury diary, dated October 30, 1794 says, "Went to launching of a ship of 500 tons; not less than 3000 persons were present." In 1800 shipbuilders from the Kennebec to the Hudson laid more keels than any other year. In the large yards of New London and New Haven, and in others less prominent along the banks of the Connecticut River as far as Hartford, ships were being rushed to completion. The industry continued to prosper until Jefferson's weird embargo dealt it a death blow. It was Connecticut's first venture in the "big business." The State used the lessons thus taught to good advantage in the century that was to follow.

Let us now go back and trace the course of one of the most far-reaching and pregnant movements in Connecticut history—the establishment of those household industries, which, germinating in cellars, barns, and by the kitchen fireside, were the seeds of the great industrial plants of the present day. To a self-reliant people the conditions of pioneer life encouraged natural inventiveness. Tools, utensils and clothing could be replaced only at great expense and even greater effort by travel-

ling over almost impassable roads to the nearest store or warehouse. A broken plow or hoe, a shortage of nails, meant a long delay in the progress of work. Hence, in a short time, the settler learned to be his own blacksmith and mechanic. In his barn or shed, he learned to make hand-wrought nails and repair tools for his own use—to do, in fact, anything that had to be done. From this it was a short step to hammering out nails and shaping tools on rainy days or during the winter, when farm work was at a standstill, to be sold to the neighbors. Weaving, of course, was the main household industry and was universal, persisting into the early nineteenth century, even after the opening of the manufacturing era and power looms. Although figures on any household industry are inaccurate and for obvious reasons difficult to obtain, it is computed that in 1810 two-thirds of the cloth in the country, including hosiery and household linens, used outside the cities, was of household manufacture. Domestic manufactures, says Bishop, were "of great aggregate value and promoted the comfort of all classes, as they greatly lessened the annual balance against the colonies and even furnished a surplus for exportation."

Prior to 1716 there are few records relating to manufacturing in Connecticut, although it was carried on to some extent during the entire eighteenth century. It was evidently a hazardous venture in those early days and the records of the General Assembly are full of appeals for aid for such undertakings. The colonial Legislature usually turned a deaf ear to these petitions, but occasionally it was in a sympathetic mood. Generally the promoters lost heavily.

A search of the General Assembly records shows the

efforts to aid the infant industries. Occasionally the Legislature granted, but more often refused, financial aid in the form of loans to the struggling individuals or companies. A frequent device was that of granting to worthy companies the exclusive right to manufacture their commodity in the colony for a specified time. For example:

1708 exclusive right was granted to one John Eliot to manufacture pitch.
1743 exclusive right to manufacture potash
1746 exclusive right to make salt in Branford and Lyme
1720 exclusive right to manufacture tar and turpentine
1736 exclusive right to manufacture bells
1747 exclusive right granted to Thomas Darling of New Haven to make window glass for twenty years provided he made 500 feet in every four years.

These small iron and textile manufactories were the feeble forerunners of the great brass, cotton, silk and woolen mills of today. They were especially significant because of their influence in localizing later industrial centers. As will be told more in detail in later chapters, long before 1800, Pattison in Berlin was making tinware to be sent throughout the colonies, marking New Britain, then a part of Berlin, as a future hardware center; Joseph Hopkins in Waterbury was making silver pewter, brass buttons and knee buckles, thereby all unconsciously localizing the brass industry in the Naugatuck Valley; while Eli Terry had just begun to make by hand clocks with wooden works, and a few daring proprietors of struggling cotton, silk, wool and paper mills were establishing local habitats for great modern enterprises in their several lines.

Under our present moral standards and legal restric-

tions it would be difficult to comprehend what an important part distilling played in the earlier history of the Commonwealth. Whether rum distilling grew out of the West Indies trade, or the West Indies trade was stimulated by the distilling industry, is problematical and immaterial. In 1810 there were 500 distilleries in Connecticut producing annually 1,374,404 gallons of spirits, and having a value of $800,000. This industry centered largely in Hartford County, and was usually conducted on a small scale, by men who devoted a portion of their time to the operation of their own farms. It was profitable as thus conducted, because the waste from the distilleries was used to fatten the live stock, which was in part shipped to the West Indies as a return cargo of the same ships that had brought in the molasses used in distilling. At that time the industry was highly reputable and looked upon with public favor.

No account of the early business enterprises of Connecticut would be complete without mention of the mines, forges and iron works which were so influential in turning the manufacturing bent of the inland colonists to the metal trades. It has been said that every known mineral can be found in the State, but in quantity just under the point of profitable production. Search for metals was early instituted in each settlement, undoubtedly in the hope of finding gold or silver; for belief in the New World as a magical storehouse of the precious metals died hard. In 1664, John Winthrop, Jr., encouraged by the temporary success of the iron works in Lynn and the need of iron for tools, shipbuilding and every activity of pioneer life, obtained a grant for a settlement and iron works in Connecticut, then a part of Massachusetts Bay Colony, where he had been pre-

viously commissioned by Lords, Say & Brook to build a fort against the Dutch. Although he retained connection with the Lynn plants, Winthrop early centered his main interest in Connecticut. His knowledge of "physical science," his ingenuity and enterprise were of great service to the young colony—his success in turning the attention of British ship-buyers in its direction having been already noted. He prospected assiduously in various metals; but he unfortunately enriched neither himself nor the colony in consequence. In 1665, however, he had Stephen Goodyear set up a forge and mill for rolling balls of iron at the outlet of Lake Salstonstall, near New Haven.

In 1707 the famous Simsbury—or Granby, then a part of Simsbury—copper mine was discovered and granted the first mining charter in America. It was worked for about seventy years, but with more adversity than success, in spite of the richness of its ore. Because of imperfect knowledge and machinery, lack of drainage and the cost of pumping, which was carried on night and day by neighboring farmers, the enterprise ultimately failed. Moreover the British Parliament did not permit refining in the colonies, and, although shiploads of the ore were occasionally sent to England, the cost of transportation wiped out the profits. A certain amount of refining, however, was done secretly by German workmen in Simsbury. The coins struck by the ingenious blacksmith, Joseph Higby, of this metal passed as current coin and were known as "Granby Coopers," now greatly prized by collectors. The Simsbury Mining Company, comprised chiefly of the landowners of the village, paid 10 shillings tax on

each ton mined, part of which went to the support of the school master and the rest to Yale University.

The Colonial Assembly, from the first, favored mining, especially by granting miners and operators exemption from four years military service. But with respect to their earlier attempts, Jonathan Trumbull in his early History of Connecticut spoke a dry truth when he remarked that "neither the undertakers nor the colony were ever greatly benefited by them. The mine at Simsbury has since become the famous prison called Newgate. And thus it has been of much greater advantage to the State than all the copper dug out of it." (1, p. 45). This great and early authority on Connecticut history, however, overlooks valuable moral and material by-products of the mine, which bore fruit in the establishment of nearby metal and copper manufactories and in stimulating the inventive genius of the surrounding localities.

Of infinitely greater importance in encouraging the metal workers was the iron found in valuable quantities in several places in Litchfield County. In 1732 the first "Salisbury Iron" was discovered at Ore Hill near the New York State line on lands appropriated by the colony to Yale College. Forges were set up at once, and by 1762 Ethan Allen with two partners had built a blast furnace, believed to have been the first in the State. They also established anchor works, and it is said that a portion of the great chain stretched across the Hudson during the Revolution as a protection against the British fleet was made by them.

This ore, a brown hematite, was of peculiar toughness and valuable for cannon, chains, gun barrels, and other products requiring great tensile strength. The

attitude of Parliament was rigidly to suppress the infant industries in the New World, and even the iron forges fell under this bann. It was, however, impossible in practice for the crown agents to be informed of every forge and iron works, especially since the local officials connived to keep the information from them. In 1750, Parliament reiterated the dictum against "erecting or operating forges, rolling or slitting mills, or the making of steel"; but apparently with little effect.

Owing to the discoveries at Ore Hill, and later elsewhere in the vicinity, Litchfield County had by the year 1800, fifty bloomery forges, three slitting mills, an anchor and screw works, and manufactured more nails than any other section of the colonies, except Plymouth and Bristol Counties in Massachusetts. In Lakeville were two refining forges, one of which boasted ten fires, engaged in making shot and shell for the British Government until the enterprise was ruined by the transfer of government patronage to Swedish iron. A deposit of spathic ore was discovered at Roxbury, and New Milford had seven forges before 1800, which were known for the excellent quality of their steel.

The acidulous Peters, in his account published in 1781, already quoted from, mentions the number of furnace and iron works in Litchfield, and in 1837 Charles Upham Rand Shepard's "Report of a Geological Survey of Connecticut," states that for forty years previous the Ore Hill mine in Salisbury had averaged 5000 tons a year. The superiority of Salisbury iron for special castings requiring great strength, such as car wheels, has justified the higher cost of production, and kept the mine open to the present time. It is operated by the Barnum Richardson Company, which dates

from 1820, when Milo Barnum built a furnace for pig iron at Lime Rock. Little else remains of the mining days of Connecticut, except the deserted furnaces dotting the Housatonic Valley in Western Connecticut.

Because of a certain romantic quality in the story of the shipping, mining, and household industries of colonial Connecticut, it is hard for us to picture the actual difficulties of getting a bare livelihood. To the natural hardships incidental to pioneer life and the artificial obstacle of British trade restrictions, should be added the constant harassment of Indian troubles, continuing until the Revolution, and also the draft upon the man-power and resources of four inter-colonial wars. Repeated quotas of men were drawn from their work to expeditions west and north to the Canadian border, such as the Louisburg raid, and as far south as Havana against the Spanish. The colonists bore their part of the expense of these expeditions, but had no share in the prizes. It is pathetic to read in the earliest histories of the sudden spurts of prosperity between wars. In 1713, on the signing of the Peace of Utrecht, Carpenter describes the colony thus: "The population of the commonwealth at the close of the war was about 17,000, distributed through four counties and forty-five towns. Its manufacturers were yet inconsiderable, there being but one fuller in the colony, most of the home-made clothing being worn without shearing or pressing. So far there has been no permanent printer in the province. In 1714, however, Mr. Timothy Green, a descendant of the first printer of Massachusetts came to New London and there set up an establishment which with government patronage continued to flourish for many years"

Trumbull adds (1763) that "the extension of the settlements, the increase of cultivation, numbers, commerce and wealth of the colony for about ten or twelve years after the Peace of Paris were almost incredible."

It is hard, too, for us to realize the insignificance of the towns. As late as 1780 Hartford, one of the nine ranking towns in the State, is described by Chastellux in his "Travels" as "one lone street parallel with the river," and further that it "did not merit attention, either in travelling through it or in speaking of it." Roads were so poor that in 1780 a horseman could make but ten miles a day with a light load, and not until the new century had they improved so that a horseman might make 50 miles a day. Most roads were impassable for carriages.

Allusion has been made to the Parliamentary restrictions on manufacture. The British attitude was foreshadowed by Lord Cornbury's Report on the Province of New York, 1705, which viewed with jealous eye the growing manufacture of woolens in Long Island and Connecticut--pitiful efforts though they were—and warned the Home Government of the necessity for a policy of discouraging all manufacturing "in order to insure dependence on England." This attitude soon became an avowed policy, and in 1718 it was declared that the "erecting of manufactories tends to lessen their dependence upon Great Britain." The little factories continued to brave, or rather ignore, this opposition and in 1731 the Crown called for a "Report of Manufactures Detrimental to the Trade, Navigation, or Manufactories of Great Britain." The Report was made but, as was perhaps natural under the circumstances, it was deliberately distorted, information

being withheld by all officials, out of loyalty to their neighbors and local prosperity. In Massachusetts, Jeremiah Dunbar was *summoned* for giving information about Massachusetts' industries. The governors of the colonies disclaimed knowledge of any manufactures worthy the name, even forges, although the Surveyor General of His Majesty's Woods writes that at that time he himself knew New England to have at least nineteen forges, and that ships and hats were being exported, and that there were several distilleries of size.

The unstable currency of the Colonial Era also added its disadvantage, as did the lack of skilled labor and even more marked lack of cheap labor. The British manufacturers saw to it that their skilled workmen did not escape to the New World and Parliament forbade the carrying out of the country of plans for machinery or improved methods. In 1731 a Report on manufactories to the General Assembly of Connecticut mentions the high price of labor as rendering the manufacture of linen cloth unprofitable in New England, the colonial cloth being "20% dearer than that exported from home for sale."

Upon the foundations sketched in this chapter was built modern industrial Connecticut. Its character came from race, church and home; its thrift and inventive genius came from necessity and character; its business training came from shipping and commerce; its capital from undissipated shipping profits and the savings of the home; its metal trades from tinware and the contiguity of now deserted mines; its stability from orderly government and generally just laws. No finer foundation could be laid for a noble civilization.

PERIOD OF TRANSITION

THE periods of history are seldom set off by sharp lines of demarcation or abrupt changes. Especially is this true of a sturdy civilization with strong fiber and stable character. Such a social organism always grows slowly. The preceding chapter covers in a general way the period of household industries and shows how, in cellars, barns and kitchens and by mill-site and in hamlet, the seeds of the modern industries of Connecticut were sown. From the political viewpoint we have covered the Colonial Period, although, of necessity, there has been some over-lapping into the period following.

The present chapter, which treats of a period beginning with the adoption of the Federal Constitution and continuing through the next three generations, will attempt to sketch the factors which brought about the transition of industry from the conditions described in the previous chapter to those resulting in a great industrial state, employing the factory system, division of labor, corporate organizations and huge plants. Political conditions here play an increasing part.

The immediate effect of the end of the Revolution was unfavorable to trade. Not only were the resources of the country exhausted by a heavy public debt and worthless paper currency, but the young republic, and hence its business, had no credit. Furthermore, in the general confusion and jealousy following the cessation of hostilities, there was no central power to regulate trade or commerce. In commercial Connecticut the valuable West Indies trade was already slipping away,

as the islands were now alien and not sister colonies under England.

The struggling new manufacturers were in an even worse position than the commercial interests. European goods were flooding the country in quantities far beyond the needs of the people, or the ability of the merchants to pay for them. The British merchants and manufacturers were determined to recapture the American market, which during the Colonial Era had been so lucrative, protected as it was by parliamentary restrictions from local competition. They therefore willingly shipped large consignments of goods on credit and at prices calculated to be ruinous to the American manufacturers, whom they had begun to fear. These foreign goods were, not unnaturally, eagerly bought by the people, who had been cut off from English luxuries not only by seven years of actual war, but by the preceding years during which public opinion and patriotic sentiments had operated as a practical restraint of trade.

The American manufacturers, on the other hand, now realized that the situation was at a turning point. They were equally determined to keep the large trade which the necessities of war had brought them. At this time, according to Coxe (Report 1813), the home manufactured goods of the United States were much greater in value than the gross value of all imports. On the surface of the situation, it would have seemed that the manufacturers' ambitions were preposterous. Their products were inferior, owing to the lack of improved machinery, methods and skilled workmen, naturally resulting from the vigilant restrictions imposed by Great Britain during the Colonial Period. This vigilance continued in force, both by laws of the English Parliament

forbidding the exportation on plans for machines or machinery and by even greater watchfulness of the manufacturers in Birmingham and Manchester. The sum of $150,000 is said to have been subscribed at one Manchester meeting to hold their trade. Capital was freely employed to enable British merchants to flood the American market, until the native industries should be driven out of competition.

In this situation it is easily understood why no class in the country was so loud in its call for a strong central government in the new Republic as the manufacturers and mechanics. They clearly saw that their only hope lay in a restoration of public and private confidence and a check on foreign importations by a revenue system. As soon, therefore, as the Constitution was adopted, memorials poured in to the Congress from New York and New England manufacturers and artizans, urging the immediate encouragement and protection of their industries. As a matter of fact, the first act of the new consolidated government was to pass a revenue and protection statute announcing it to be "necessary for the support of the government for the discharge of the debts of the United States and the encouragement and protection of manufacturers that duties be laid" on certain goods, wares and merchandise. It was brought forward by Madison within two days after the counting of the presidential vote and before the routine of business had been started after the inauguration of Washington. The bill was signed by President Washington on the national anniversary of the United States. This early tariff protected practically all Connecticut industries, the metal trades and textiles.

Connecticut owes in this connection an inestimable

debt of gratitude to the far-seeing vision of Alexander Hamilton, the first Secretary of the Treasury. His celebrated Report in 1790 in favor of the manufactures is one of the ablest state papers in the national archives. Many of its arguments, at that time novel, have now passed into axioms. Every argument was used, and indeed exhausted, in favor of the policy and expediency of protecting and encouraging this branch of domestic economy. This insight into the real possibility of America's future greatness is the more remarkable, as Hamilton's own previous associations had been commercial rather than industrial, and the interest of the East at that time was in commerce, industry being a decidedly minor consideration.

The Report mentions each branch of manufacture in detail, naming specific plants as occasion arises. His reference to Connecticut is of interest as showing the state of Connecticut industry at that period.

Iron—nails and implements, edge tools and "other infant branches of the Iron manufacture."

Copper—including Connecticut brass.

Flax, Hemp and Cotton—mentioning specifically the already celebrated Providence mill of Samuel Slater and "other manufacturers—begun at different places in the state of Connecticut but all upon a smaller scale."

Wool—mentions hats and "a promising essay toward fabrication of cloths, cassimeres, and other woolen goods, is likewise going on at Hartford, in Connecticut."

Silk—"Some pleasing essays are made in Connecticut."

In addition to protection, the bill further provided for bounties for special articles, and a Board to promote arts, agriculture, manufacturing and commerce, under the terms of which were appointed Commissioners who were provided with funds to defray the expenses of the

immigration into the United States of "artists" (artizans) and manufacturers in particular branches of industry. The Commissioners might also give rewards for inventions and improvements, with an idea to enticing skilled workmen here and the improvement of machinery. In short, every possible governmental agency was invoked in the aid of the young industries.

Other conditions also began to operate in their favor in Connecticut. About the year 1800 the agricultural development of the State was felt to have reached its limit, and ambitious men were faced with two alternatives: to emigrate to the broader lands in the West, or to remain and engage in trade or manufacture. That there was considerable emigration up to 1840 is shown in the census reports. But many enterprising and resourceful men elected to remain in Connecticut and saw more future in local manufacturing than in western farming. These men had, for the most part, been trained as boys in that well-nigh universal school of household production described in the previous chapter. The wars were over, the extreme rigor of life in the wilderness was giving way to more leisure and comfort. Easier methods of communication and transportation were opening the door to a new era. In 1800 Hartford and New Haven were on a regular stage route between New York and Boston, insuring them of connection with the larger world.

The vital dependence of production upon transportation, which has recently had a striking recognition in the refunding of the so-called Foreign Loan of the New York, New Haven and Hartford Railroad by the initiative of organized manufacturers, was demonstrated at this time. Up to the Revolution the roads had been

scarcely more than roughly widened trails. A horseman, with a light burden, could proceed no more than 10 miles a day. About 1800, however, turnpike companies began to be incorporated for the purpose of improving the main highways. Gallatin's Report on Public Roads and Canals, 1807, states that a "great number of artificial roads have been completed in the Eastern and Middle States at a cost varying from $1000 to $14,000 a mile. In Connecticut alone there were fifty turnpike companies incorporated within five years. All roads undertaken by them were turnpikes, of which thirty-nine extending 770 miles are complete. The most expensive was that from New Haven to Hartford at a cost of $2,280 per mile with a net income from tolls of $3,000."

Other factors also operated in favor of the young industries during the opening years of the new Republic. They were freed from the onerous taxes, internal restrictions and monopolies of trade from which they had suffered under the Crown. They were close to New York and Boston markets, and possessed, through their navigable rivers, favorable means for transportation. The decline of shipping, previously discussed, released capital for industrial investment and left available a group of men with business training.

On the whole, however, industrial and social reactions during the opening decades of the independent history of the country show little parallel with the revolutionary political changes which were taking place. It was in 1808 that an abrupt change took place in the relationship between industry and politics. The most picturesque of the political moves of the period was Jefferson's famous Embargo.

In its efforts to cope with an increasingly difficult British situation and yet avoid a war, Jefferson's administration hit upon what appeared to them to be an inspired scheme to satisfy all parties. This was to establish an embargo which operated to prohibit the exportation of all American goods. But this measure, being an evasion, ended in satisfying no one. Probably no political measure in the history of this country had as little basis either in economics or common sense. It is interesting to note its immediate and ultimate effects upon the business of Connecticut and all New England. Jefferson, however, was apparently pleased with the scheme, which promised to be popular with the agricultural South. But the measure proved a boomerang. Temporarily it all but ruined New England and made that entire section of the country hostile to the Democratic-Republican party; and, to their aggrieved surprise, it also injured the South. The agriculturists soon learned that they could not sell a surplus without a commercial district to buy it. In other words, they learned the old lesson, that if one part of the country is in an unhealthy condition, another cannot prosper. Since the prosperity of the Commonwealth of Connecticut still depended largely on shipping, the effect there was calamitous. In 1808 in New Haven alone 78 vessels were embargoed and the State exportation fell from $1,625,000 in 1807 to $414,000 in 1808. Farmers and merchants were in despair while sailors, shipbuilders, and allied workmen were unemployed.

Petitions and appeals poured into Washington describing the situation. The Democratic-Republicans for the most part suffered in silence, but the Federalists, with political bitterness added to their financial losses,

and because they were the moneyed party, became more and more rancorous as their ships lay idle year after year. They openly charged that the embargo was a deliberate attempt on the part of the Democratic-Republicans to destroy New England's maritime wealth. The "Connecticut Courant" denounced the "Dambargo" scathingly, saying that the "little finger of Thomas Jefferson was heavier than the loins of George the Third." Governor Treadwell's speech, May, 1810, bitterly assailed it, saying, "I read not a word of manufactures, although they are more formidable to Britain than a navy of one hundred ships of the line."

But the embargo gave way only to the War of 1812, which was equally disastrous to shipping and, by the end of the contest, the more far-sighted capitalists in Connecticut realized that shipping had had its death blow. The Napoleonic Wars, which had occupied European attention so long, were over and foreign competitors again turned with vigor to their own long neglected shipping. The West Indies trade was lost, and after a few attempts at its renewal, shipping and shipbuilding declined steadily, New York absorbing the commerce.

The familiar slogan—one of the most apt inspired by the recent World War—that a man "may be down, but he is never out" applied with peculiar force to the indomitable captains of Connecticut industry and commerce of that period. Indeed this catastrophe, which seemed at the time to mark the end of the prosperity of the State—the farmers and merchants being as hard-hit as the shipping interests—proved to be a distinct blessing in disguise. It cleared the decks for the rapid rise of Connecticut as a manufacturing state,—for in

line with the dim prophecy of the delegates to the Constitutional Convention, and undreamed of by the great mass of its citizens, here lay the open sesame of Connecticut's greatness. In the end, New York and Boston would doubtless have largely absorbed the shipping interests under any circumstances, and with the westward migration to broader and more fertile lands, Connecticut would have soon lagged to the rear as a distinctly agricultural state.

In 1812, war with England was declared and during its continuance intercourse with England was prohibited and import duties were doubled. These political conditions blocked the accustomed channels of exchange and vastly stimulated those branches of industry whose products had hitherto been imported. Viewing the nation as a whole, Professor Taussig makes this comment: "Establishments for the manufacture of cotton goods, woolen clothes, iron, glass, pottery, and other articles, sprang up with a mushroom growth. We shall have occasion to refer more in detail to this growth when the history of some of these manufactures comes to be considered separately. It is sufficient here to note that the restrictive legislation of 1808–15 was, for the time being, equivalent to extreme protection."

In Connecticut the great brass and hardware industries, the famous clock factories, woolen and cotton mills, "manufactories" of every sort sprung up on every stream. By 1810 Connecticut had 14 cotton mills, 15 woolen mills, eight blast furnaces, 48 forges and 4 brass foundries, beside smaller enterprises, such as glass works, potteries, plate mills, gunpowder and carriage manufactories. In the next twenty-five years were founded many of the great concerns whose plants

now cover many square acres, and whose products are sold all over the world. The great metal industry in Waterbury and the Naugatuck Valley; the hardware manufacturing of New Britain and Hartford County; the cotton textiles overflowing into Windham County from Providence; the silver cities, Meriden and Wallingford, growing up from a few pewter shops; hat manufacturing centering in Danbury; carriage building in New Haven; and the clock industry in Bristol and Plymouth —these waxed stronger and grew to adolescence.

But in order to make hay during the sunshine of this period of freedom from foreign competition it was of course necessary to secure those indispensible requisites of successful industry—skilled labor and improved machinery. In the succeeding chapters treating the special industrial groups it will be of interest to note the devious methods by which the old founders smuggled into the State from Birmingham and Manchester the newly invented and improved machinery of England and the skilled workmen who were familiar with its use. In spite of the restrictive measures passed by the British Parliament, considerable numbers of master craftsmen were enticed to Connecticut; or, realizing the expanding field for their labors in the New World, immigrated voluntarily. Connecticut's debt to this machinery and these workmen is incalculable.

Another factor which enabled Connecticut manufacturers to take advantage of this period and supplement the skilled labor and machinery filched from the Mother Country was the rare native inventive ability of the State's own citizens. This seems to have been for some reason one of Connecticut's peculiar endowments. During most of the years since the nation came into being

the State has led in the number of patents issued to its citizens. Manual dexterity, indeed, is one of the attributes associated with the term "Yankee." The chapters that follow are replete with examples of original inventions and improvements upon old methods.

The greatest factor, however, in effecting this transition was the development by Eli Whitney of the modern system of quantity production and interchangeable parts through division of labor, generally described as the "factory system," and its general adoption by the industries of the State and nation. The fundamental difference between the old craftsmanship method of production and the modern factory system can be best illustrated by a concrete example drawn from fire-arms. In the chapter on "Munitions" the rare skill of Simeon North and his associates of Berlin in producing pistols, is pointed out. But under North's plan, which is typical of all production of the period, each craftsman made a complete weapon. Whitney, however, having been deprived of the fruits of his invention of the cotton-gin, brought his genius to bear in another direction, which, less spectacular and enjoying practically no mention in the standard American histories, was of even greater value to Connecticut in particular and American civilization in general. During the Revolution and thereafter he had taken large contracts to furnish arms to the Continental Government and its successors and proceeded to devise a method, now so commonplace as to be taken for granted, of making each part of his guns in quantity and perfectly standardized so that the trigger, lock, stock, or barrel of any one weapon would fit perfectly with any other weapon of the same type. Furthermore, he assigned to each workman one particular operation, that

being his own small part in the production of a completed product. Special tools and machinery were devised to standardize each part to the smallest fraction of an inch. Although this method killed forever the old craftsmanship and much of the joy and pride of creation of the former days when an artizan had been called an "artist," the Alladin's Lamp of quantity production and mechanical accuracy had been discovered and civilization as a whole has been made incomparably richer because of Whitney's contribution. Similar methods were being developed in England contemporaneously, but there is no reason to believe that either part of the world had knowledge of what the other part was doing.

An interesting side-light on the times is the opposition to the factory system which manifested itself during this period. It was branded by exponents of the household system as "immoral," and the Federalist Party in Connecticut, which was the representative of conservatism and property and whose members had been largely engaged in commerce and shipbuilding, favored the household plan as opposed to the "pernicious" factory system.

Another characteristic of the period of transition was the gradual shifting of population from country to city. The modern growth of Hartford, New Haven, Waterbury, and other cities dates from this period. It would give, however, a false picture, if the impression were to be left that Connecticut, even after the events which have been described, had become an industrial State. The census of 1920 shows only 6.4% of the population engaged in manufactures. Neither did the State at this time enjoy any particular preëminence in industry, except in specialized lines. According to

available figures, Connecticut in 1820 had an industrial capitalization of only $1,300,000 authorized by state laws, compared with New Hampshire's $5,830,000. But the drift of population from agriculture to manufacturing and from town to city was setting in. The day of the household industry and handicraft production had passed.

Out of the restrictions of the War of 1812 and the political events immediately preceding it grew the modern system—or, as it is sometimes called, the "American system,"—of protection to industries through the tariff. An account of the various controversies in this relation which engrossed Congress and the public during the next generation does not belong in this volume. Neither, except incidentally and as it may apply to the ups and downs of particular industries and groups, does the shifting fiscal and monetary policy of the nation during this period of the country belong here. It is sufficient to say that Connecticut manufacturers became early imbued with the conviction that their prosperity was vitally dependent upon some degree of relief from foreign competition, and it will be noted in some of the ensuing chapters that the federal policy was vigilantly watched by them.

The final transition to modern conditions was brought about when the inventor and founder was gradually succeeded by the organizer. In tracing the history of the special industries there will be noted the extent to which financial organization and skilled salesmanship gradually came to be the talismen of success. A young industry would be organized and either stagger or fall. The management of some neighboring concern would proceed to buy it. This concern in turn would combine

with other concerns. There was a constant shifting of ownership and firm names during a large part of the succeeding century. However, after the Civil War there appears a more or less distinct change in industrial organization. This came about to some extent through "pools" and trade agreements. While Connecticut still possesses to a peculiar degree large numbers of private or family-owned concerns, the era of great combinations of national scope is slowly invading its borders.

We have considered the historical beginnings of industrial Connecticut, and crossed the bridge to the Connecticut of today. The factors which have transformed colonial Connecticut into modern industrial Connecticut have been sketched in this chapter,—the application to changed conditions of the business experience learned through shipbuilding and commerce during the Colonial Period, the availability of accumulated capital surviving from that period, the political events which for nearly a decade completely freed our manufacturers from foreign competition, the general adoption of the modern factory system, the more or less surreptitious importation of improved machinery and skilled labor from the Mother Country, the development of rare inventive genius among Connecticut citizens, the enactment of Federal laws which have been on the whole favorable to industry, the development of a generation of financial organizers and master salesmen, and, underlying all of these, the sterling qualities of Connecticut citizenry. We are now ready to enter upon the detailed accounts of the several industries which have made the State famous.

CLOCKS AND WATCHES

SINCE before the founding of the Republic the eyes of thrifty early risers and apprehensive late wooers throughout the land must have rested more frequently upon the word "Connecticut" than on any other in the language. From the days when the big "grandfather's clock" occupied the place of honor in the home, down to the present period of assorted timepieces of every style and description assigned to each member of the household, the name of the snug little State of Connecticut has been the symbol of mealtime, schooltime, bedtime, business promptness and orderly living.

The three great fathers of American clock making—Eli Terry, Seth Thomas, and Chauncey Jerome—were all Connecticut Yankees. So too, were the Hoadleys, Ingrahams, and William L. Gilbert, who built upon their foundations. Not only have the products of these founders and builders served the households and business institutions of their native land, but they have entered the homes and commercial establishments of all civilized peoples.

Long before the signing of the Declaration of Independence, isolated makers of clocks on a small scale were scattered throughout most of the northern British colonies of the New World. In New England they were especially plentiful. They worked as cobblers then worked, in their own homes, or in small shops, with perhaps a joiner or two, and with an apprentice to help. Clock making was then a "mystery and a craft." Until the nineteenth century was well on its way, this was the state of the industry in America. At that time Connec-

ticut enjoyed no particular distinction in the art. Her subsequent leadership was due to the fortunate coincidence of her possession of the three leaders above mentioned. As in the hardware trades, which centered about New Britain, so in the clock industry, salesmanship was the indispensable handmaid to production. As Pattison of Berlin peddled the tinware that had been made in his shop, so did the early clock makers perform the double role of makers and sellers. At first the clocks were made to order, but in the course of time the practice of manufacturing small quantities in advance and selling from stock was adopted. The pioneer activities of Eli Terry in this respect will be referred to later. Many of these early clock makers knew their business and turned out remarkable products, both as timekeepers and specimens of cabinet-making, but it was the three leaders who popularized the clock and converted it from an expensive luxury into a household necessity.

Many of the early clock makers were also watchmakers, jewelers and silversmiths. Thomas Harland, the teacher of Eli Terry, was distinguished in his day as a jeweler, silversmith, watchmaker and repairer, rather than as a clock maker. The industry was conducted on a household scale in several towns, the records mentioning Waterbury, Bristol, Meriden, Plymouth and Winchester. Daniel Burnap of East Windsor was a maker of wooden clocks, whose timepieces were of fine workmanship. The first of his clocks is charged upon his books under date of 1790 at three pounds twelve shillings and eight pence. In East Hartford "a Mr. Cheney," in Litchfield, Thomas Barnes, in Bristol, Gideon Roberts, and in Waterbury, James Harrison, are named in the early records. In 1783 there is re-

corded the interesting incident of a patent awarded by the General Assembly to one Benjamin Hanks of Litchfield for a clock which wound itself up by the aid of the air, and was claimed by its inventor to keep more regular time than key-wound clocks. Nothing further is heard of the experiment, but a somewhat similar principle was afterwards successfully applied. In 1807 Riley Whiting of Winsted commenced the construction of wooden works clocks, and made numerous improvements in the works and cases. By 1820 Litchfield County had six clock-making establishments, both brass and wooden works. At about 1840 a correspondent of the "Rochester Democrat" residing in Hartford mentioned the phenomenal increase of the industry, stating that "within a few hours ride of this city 1000 clocks are finished daily, and it is a fair estimate to put down 500,000 clocks as being manufactured in this State last year." By 1886, of the thirty factories in Bristol alone, fifteen were then engaged in making clocks, or parts of clocks. This business has never slipped away from the State, there being at the present time but two or three concerns in the country outside its borders manufacturing clocks on a large scale. Connecticut still supplies the nation, and in addition maintains a considerable export trade.

The story really begins with the picturesque and striking careers of the three founders of the industry.

Eli Terry was born in East Windsor just before the American Revolution. By the time he was twenty years of age he had received a general training in the art of clock making, cutting the wheels out of hard wood with a saw and file, attaching the wooden hands and providing the works with wooden dials in cases. Moving to Plymouth, near Waterbury, he set up a small shop

and employed several workmen. With this personnel it was his practice to make up a dozen or so clocks and market them on horseback, sometimes extending his trips as far as the "new country" across the New York State line. With one clock in each saddle-bag and one strapped to his back he must have presented a quaint figure.

These clocks were expensive, costing for the cheapest $20 and often for special orders as much as $50—this at a time when money had a much greater relative purchasing power than now, and people were less accustomed to spend it on luxuries. The purchase of a clock in those days was a family event, comparable indeed with the purchase of a spinning wheel, or the buying of a new automobile in the present day.

There is an anecdote which illustrates Terry's Yankee resourcefulness in salesmanship. He had in mind as a possible purchaser of a clock a certain prosperous farmer, but had been unable to persuade him that a clock was a necessity rather than a luxury. He therefore proceeded to teach the unwilling prospect a lesson in dependency upon a timepiece. One day during a rainstorm he sought refuge at the farmer's house and brought with him one of the clocks and placed it on the mantel over the fireplace, asking permission to leave it for a few days in a safe, dry place while he proceeded on his journey. When he returned he found, as he had anticipated, that the skeptical agriculturalist was ready to buy the timepiece. Modern speakers and writers on salesmanship are able to point out few more pertinent lessons in the ancient art than that exemplified in this incident.

The cases of Terry's clocks were beautiful examples

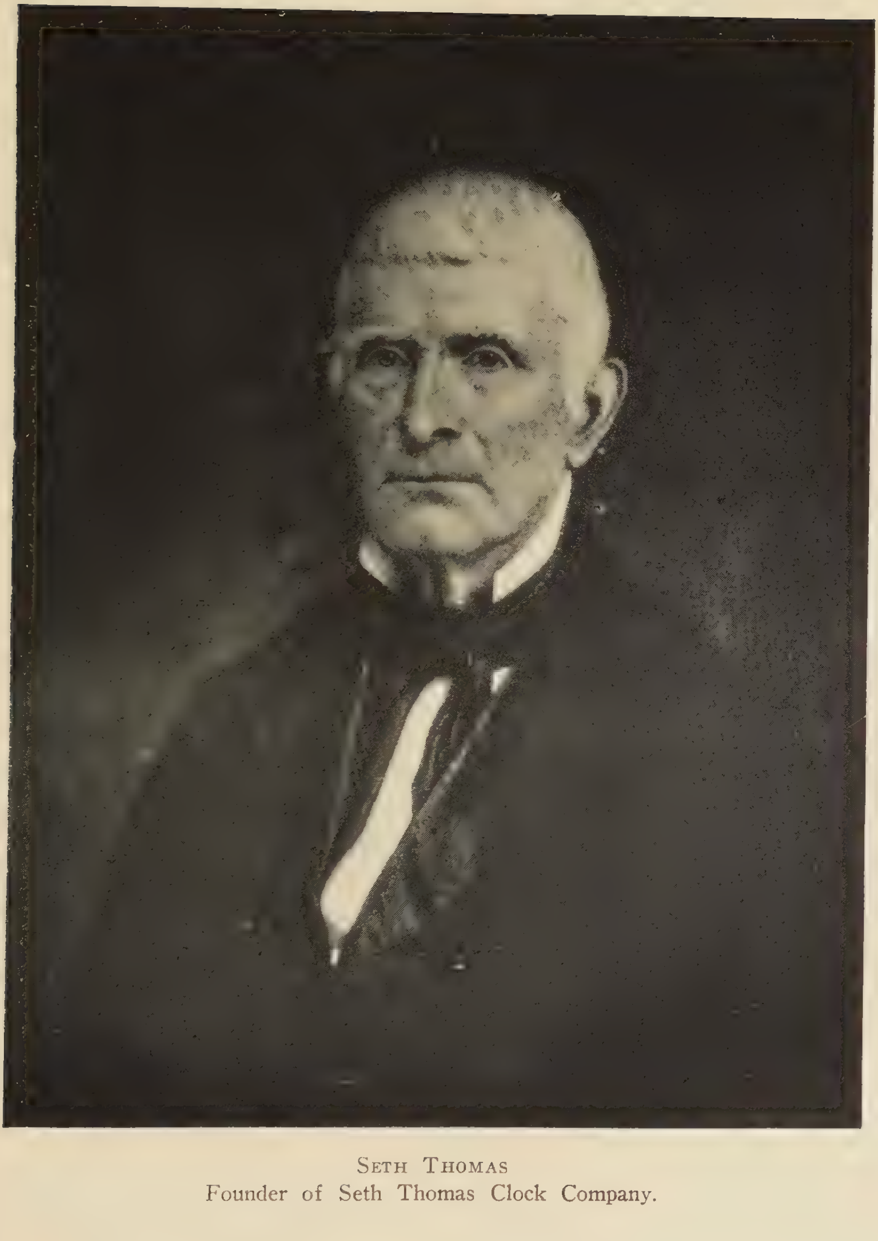
of the cabinet-maker's craft. They were almost always of the so-called "mantel clock" type—about two feet high designed to decorate the mantel over the fireplace, whereas the earliest Colonial clocks were generally of the tall "grandfather" or hall-clock type. The reason for the change inaugurated by Terry is simple—that he could not carry works of large clocks about the narrow and difficult roads on horseback.

He was not only ingenious, industrious and skillful, but was also inventive to a degree. In 1796, when he had barely attained his majority, he received a patent for an equation clock, which would show the difference between apparent time and mean time. He applied his ingenuity to the processes of production. He adapted a hand engine to cut the teeth of the clock wheels and other parts. As his business expanded he moved from Plymouth down into Plymouth Hollow, near what came to be known as "Terry's Bridge." Here he converted to his purposes an old waterpower mill and, devising all his own machinery, applied power for the first time in the construction of American clocks. This use of machinery so reduced the cost of production that the selling price was cut nearly in half. Following economic law, the lower price brought a corresponding increase in output and before long he was making clocks in lots of a hundred, and finally by thousands. His astonished neighbors with ominous head-shakings warned him that, even if he could make 1,000 clocks a year, he would never live to sell them all, but during the next two years his gratuitous advisers saw him sell more than 4,000 clocks. By the time of his death an output of from 10,000 to 12,000 clocks a year had made him a wealthy man.

In connection with Terry's career, credit should be given to Thomas Harland, already mentioned as his teacher, who was a highly competent craftsman trained in the English school. To a considerable extent, "the mystery" of Connecticut's leadership is thus accounted for. Terry, however, thus thoroughly taught, proceeded far beyond his teaching. He continued in the clock business until his death. Of his three sons, Eli Terry, Jr., who died at the age of 42, is reputed to have made a considerable fortune out of the industry; Silas B. Terry was a clever workman, but more an inventor and mechanician than a manufacturer; while Henry Terry, the third son, possessed the instincts and capabilities of a manufacturer. The last of the three ultimately drifted from clock making into woolen manufacture, and all of the Terrys were apparently through with the clock business before the Civil War.

Seth Thomas, the second of the three founders, and unquestionably the most widely known name in the clock industry, learned the craft from Terry. Soon after Terry started his factory at Plymouth, Thomas, then a young carpenter and cabinet-maker who had been engaged in the construction of the Long Wharf at New Haven, arrived at the old mill and applied for a job. He was soon placed at the head of the case-making department and in a year or two he, along with Silas Hoadley, another of Terry's men, was taken in the partnership of Terry, Thomas & Hoadley. Although the firm was short-lived, it continued long enough to demonstrate the value of factory methods in clock production.

Thomas, wishing to build up his own company, left Terry and founded the famous "Seth Thomas Clock Company," the one concern engaged in the industry



Seth Thomas
Founder of Seth Thomas Clock Company.

which has always remained under the control of the family, the fourth Seth Thomas now being president of the concern. Aside from his skill as a workman and ability as an organizer, the original Seth Thomas impressed upon his entire organization the fundamental idea that a clock must be, first of all, well made. Although the company makes a wider variety of clocks than any other manufacturer in the United States, this standard has always been adhered to. It produces pendulum clocks and lever clocks, weight driven or spring driven; cases in mahogany or oak, gold plate or glass, brass or nickel; mantel or hanging clocks; plain keystone movements or jewelled movements; 8-day or 1-day; Westminster chimes or hour-strike; 30 day office clocks or government regulators; small desk clocks, that you may put in your pocket or a Colgate clock with half-ton hands and a 38-foot dial that you can read across the Hudson River; clocks for the railroad train dispatcher or the United States Navy; clocks in white enamel for the bathroom or hospital and four-dial clocks for the church tower; electric driven clocks, precision clocks, self-winding clocks, alarm clocks, grandfather clocks, bracket clocks, post clocks, bedroom radium dial clocks and old-fashioned shelf clocks. There are few known varieties of clocks of which examples may not be found bearing the name of "Seth Thomas."

The following news item, appearing in a Hartford paper under the date-line of September 12, 1924, graphically illustrates the capacity of this internationally known plant:

> The largest clock in the world, a timepiece whose face is fifty feet across and whose minute hand weighs more than a ton, 2,200

pounds to be exact, has just been completed and shipped by the Seth Thomas Clock Company to the plant of Colgate and Company in Jersey City, where it will surmount a large advertising sign and be visible for miles down New York harbor. A flat car was required to ship the hands as they would not fit in a box car.

Every hour of the day the minute hand will travel 157 feet—almost a yard every minute. Mechlin, Belgium, alone has a clock which approaches this new timepiece in size. In the Middle Ages monks constructed a clock with a face forty feet across and only one hand. This clock, however, was partly destroyed in the German invasion and has been long out of use.

The third, youngest and in some respects the greatest, of the "fathers" of Connecticut clock making was Chauncey Jerome. Like Thomas, he was originally a carpenter, and as a boy he had worked for him during his carpenter days. He served in the War of 1812, but returned to his trade after the war. At another time he was in the employ of Eli Terry, and, being a skilled joiner, had designed with Terry some of the most familiar types of scroll clocks, notably the square clock with columns at the corners and a scroll top, and the square clock with a mirror or picture beneath the dial. "Of the three," says an authority, "Jerome was more the inventor and less the business man." His two masters had been emphatically both inventors and business men. Although Jerome never entirely deserted the clock industry, he was constantly changing his business associations and experimenting with companies and processes, so that his life is a chapter of good fortunes and reverses.

In 1817 Jerome also formed his own company in Plymouth—the Jerome Clock Company—which in 1821 was removed to the nearby town of Bristol where a larger factory was opened. It is interesting to note that

CHAUNCEY JEROME

Born in Canaan, Conn., June 10, 1793; died in New Haven April 20, 1868. Pioneer Clock Manufacturer contemporary with Eli Terry, Seth Thomas, Elias Ingraham. Founder of New Haven Clock Company. Mayor of New Haven 1852–1853.

this plant contained the first circular saw ever used in Bristol. The company continued to manufacture brass work clocks in that town, until it moved to New Haven in 1845.

To Jerome must be accredited what is economically the greatest and most far-reaching contribution made to the clock industry in Connecticut—that of the substitution of brass works for wooden works. The idea was not original with Jerome, but it was he who made it practicable. Before 1800, efforts had been made to use brass for making the works of clocks, the wheels being cast and thereafter finished by hand. As is so frequently the case, it was the pressure of circumstances which stimulated this important departure. The difficulty of securing a supply of wood properly seasoned and hard enough to resist dampness, so that clocks might be shipped by sea to the South, caused Jerome to cast about for some other material. During the early periods of his manufacture at Plymouth he had spent his summers travelling by wagon and ship from Maine to North Carolina, selling his winter's output, and, like other clock makers eager to capture the Southern trade where profits were particularly high, was embarrassed by the occasional swelling of the wooden parts during the voyage, thereby rendering the works useless. Iron and steel were tried, but rejected because of rust. Cast brass was too expensive. The few cast brass clocks which had been previously made cost from $40 to $75, and were too unwieldy when finished to compete with the imported metal clocks then on the market. Finally, about 1825, sheet brass was tried and found successful, the parts being cut from the metal by machinery—the first wheels being cut, it is said, from old kettles. These

sheet brass clocks were designed as exact copies of the popular 8-day wooden-works clocks, but the latter were at this time being sold by Terry and others in such quantities and at such constantly reduced prices, about $15. apiece, that brass clocks, costing at least $20 apiece made little headway. In 1837 Jerome perfected a small one-day brass-work clock in a wooden case, which he found he could produce for $6 and was the cheapest clock that had been offered up to that time. Soon he found himself able to sell his clocks at $4 and $5, was shipping them all over the country, and rapidly accumulating a fortune.

Exhilarated by his success, Jerome decided to "carry the war into Italy." Although England was at that time the chief clock maker of the world and British labor was cheaper than that in the United States, Jerome decided, now that his clocks could withstand a sea voyage, to enter the export trade. He sent his son to England with a cargo of clocks, but the English, with characteristic British conservatism, would have nothing to do with a clock sold at so cheap a price. They frankly suspected some sharp Yankee trick. The best that young Jerome could do was to leave a few here and there at retail stores on consignment. The enterprise was saved by a comedy. It so happened that under the existing British revenue law the shipper was permitted to fix his own valuation of the commodity to be imported; and, in order to prevent manufacturers undervaluation of cargoes, the government had reserved the right to seize any importations suspected of having been fraudulently marked down. For goods so seized, the government paid a price of ten per cent above the owner's valuation. Jerome's clocks had been honestly

THE NEW HAVEN CLOCK CO.—SUCCESSORS TO JEROME CLOCK CO.
(FOUNDED 1817)

Factory in 1850

Present Plant

valued at the wholesale rates, but the figure was so low that no clock had ever been heard of in England at such a price. The government therefore, believing the American manufacturer was dodging import duty, proceeded to seize the cargo that young Jerome had been struggling to sell, and pay him therefore a flat ten per cent profit! This greatly appealed to the business instincts and Yankee humor of the elder Jerome and another cargo was at once dispatched to England, which was with like promptness seized at a ten per cent profit. On receipt of the third cargo, however, the ruse penetrated the intelligence of the English customs officials and they decided to go out of the clock business and let the imports through; but not before, through their kind offices, enough of Jerome's clocks had been distributed in England to create a retail demand for them. Thus was begun the exportation of timepieces from Connecticut, which has continued prosperously down to the present day.

For some years Jerome continued to manufacture and sell his product in this country, being recognized as the largest manufacturer of clocks in the United States. In 1844 he established a branch office in New Haven and when, in the year following, his Bristol factory burned, he moved his entire plant to the former city and located it where its lineal successor The New Haven Clock Company, now stands. By this time he was able to sell his cheapest brass clocks at a wholesale price of 75 cents apiece—an incredibly low figure.

His financial craft, however, proceeding apparently under full sail and clear sky, was headed for the reefs. It was expanding too much on small capital, and just before the Civil War this old and famous company

failed. According to the account appearing in "Time Telling Through the Ages," the failure came about through its connection with the famous showman, P. T. Barnum. This authority says: "The story is too complicated to give here in detail, but it seems that Barnum had become heavily interested in a smaller clock company, which was merged with Jerome's concern. The over-valuation of its stock, combined with the mismanagement and speculation among the officials of the Jerome Company, served to drive the whole business into bankruptcy. Barnum lost heavily, and it took him years to clear up his obligations. Jerome never did recover from it and after some years of failing power in the employ of other manufacturers, he died in comparative poverty."

Jerome's career is treated somewhat more fully than that of his two predecessors, because it spanned the growth of clock making from the days when it was a household industry in which wooden clocks were sawed by hand to the modern system of metal works, factory methods and quantity production. Says one of his biographers:—"He had made clocks all over Connecticut,—in Plymouth, Farmington, Bristol, New Haven and Waterbury; in Massachusetts; in South Carolina; and in Virginia. He had worked with his hands for Terry and Seth Thomas at the old wooden wheels and veneered cases which were peddled about the country on horseback and sold for $40 or $30 each to be the treasured timekeeper of many households. And he had headed a modern factory turning out a dollar clock by the tens of thousands." Jerome himself, in his book entitled "A Century of American Clockmaking" tells the romantic story of this

PLANT OF THE E. INGRAHAM COMPANY,
BRISTOL, CONN.

Case Department—Length, 424 feet

Partial View of Plant from Rear

Movement Department—Length, 469 feet

THE E. INGRAHAM COMPANY, BRISTOL, CONN., CLOCK MAKERS FOR ONE HUNDRED YEARS

Elias Ingraham

Founder and President
1824–1885

Edward Ingraham

President
1885-1892

Walter A. Ingraham

President
1892 to date

Wm S. Ingraham

Treasurer and General Manager
1892 to date

busy lifetime in a delightfully frank and naive fashion. By his own confessions he was one of the "easiest marks" in Connecticut. His work, however, was fundamental in the establishment of the industry.

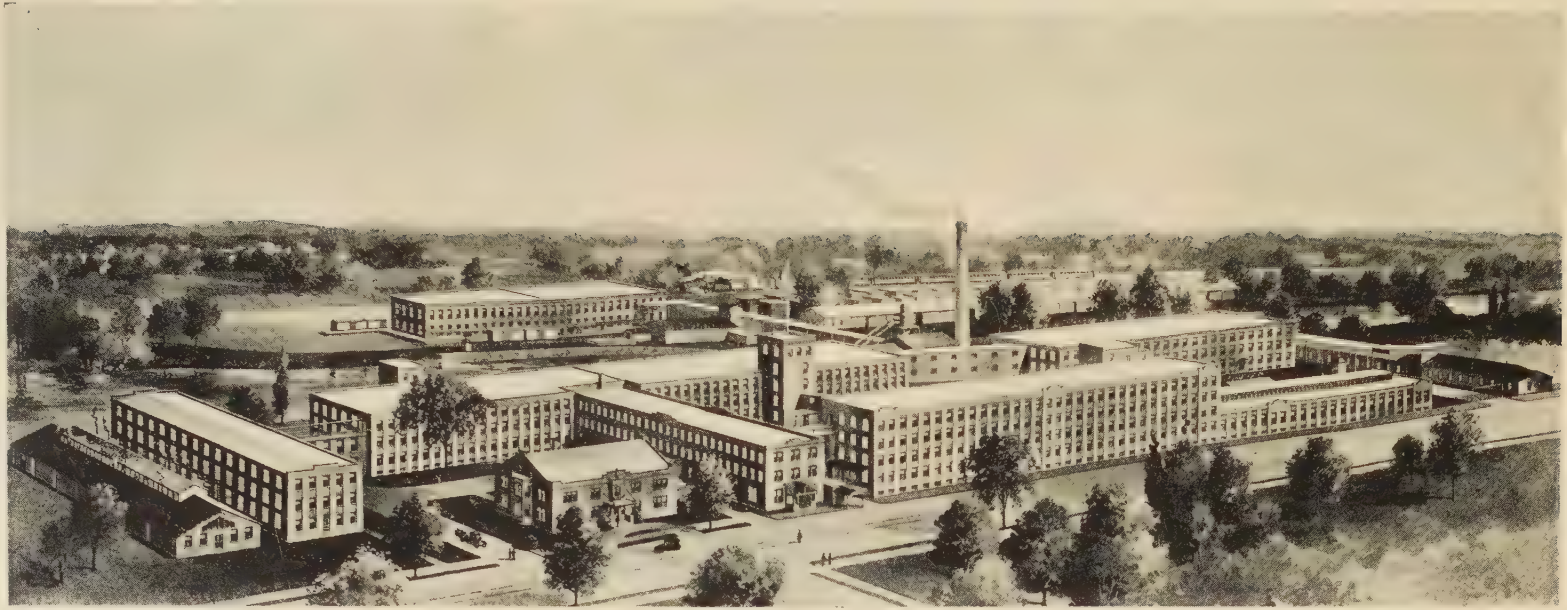
The lineal descent of the New Haven Clock Company, now the largest producers of clocks in the State, from the Jerome Company has already been noted. The New Haven Clock Company purchased the Jerome Clock Company after its disastrous failure, and, with the adoption of sounder financial practices, carried on the general policies of its great founder. In 1864 the company had 250 employees and was exporting 150,000 clocks a year to England, in addition to its domestic trade. The modern factory system was by this time far developed, the production, for example, of an ordinary "O G" clock being thoroughly systematized after this manner: Labor 20c; dial less than 5c; tablets about 4c; and movements for 1-day brass clock less than 50c. While developing more advanced ideas in production and the diversification of the business, Jerome's basic principle of a large standardized out-put of inexpensive timepieces within the reach of all has been adhered to. It became the first company to produce nickel alarm clocks and was a pioneer in the production of the "dollar watch." During recent years its lines have been further expanded to include wrist and pocket watches and various types of public and private clocks. The plant covers two city blocks, employs 1800 workmen and produces about 2,500,000 timepieces annually. Branch sales offices are maintained in New York City, Chicago, Toronto, and San Francisco.

Another prosperous concern which antedates most existing clock manufactories is that now known as the

E. Ingraham Company of Bristol. This business was founded by Elias Ingraham, who was born in Marlborough, Massachusetts, in 1805. Like other successful clock makers, he served his apprenticeship as a cabinet-maker, and, discerning the opportunities in the growing clock business, came to Bristol in 1823 and began making clock cases under contract for Lawson and Chauncey Ives. Twelve years later he bought a shop with water privileges, located where one of the company's factories now stands, and commenced the manufacture of clocks on his own account.

He continued the conduct of this industry until 1843, when a partnership was formed between himself, Elisha C. Brewster and Andrew Ingraham under the firm name of Brewster and Ingraham. In 1848 this co-partnership was succeeded by the firm of E. & A. Ingraham, who continued in business until 1855, when their plant was entirely destroyed by fire. In 1859 Elias Ingraham formed a co-partnership with his son Edward Ingraham, which continued in operation until 1881, when the business incorporated under the name of The E. Ingraham & Company, later changed to The E. Ingraham Company.

One of the notable contributions of Elias Ingraham to the clock industry was the so-called "Sharp Gothic" clock, which was designed while he was on a sailing voyage to Caracus to introduce his output in South America. The pattern for this famous clock was whittled out of a block of wood to beguile the tedium of the trip. It proved to be one of his greatest successes, finding such an extensive market in this and other countries that it is believed to be the largest selling clock of its period. Several other popular patterns of clocks made



The Home of Sessions Clocks, Forestville, Conn., U. S. A.

TYPES OF SESSIONS CLOCKS

THE CHIPPENDALE
A Period Reproduction

THE REVERE
A Wall Clock of the Banjo Type

THE BALDWIN
An example of the ornate and polished black wood

THE WINDSOR
A modern Tambour

A Carved Mahogany Cabinet

prior to 1875 were also designed by the elder Ingraham and were called the "Doric," "Grecian" and "Ionic." Edward Ingraham, his son, originated the "Black Enamel" clocks. About the year 1898 the company took up the manufacture of common alarm clocks, in 1913 that of low-priced watches, and in 1915 that of 8-day alarm clocks. This business has always been conservatively managed and possesses high-grade equipment and a well developed personnel.

The Sessions Clock Company of Bristol is another concern with a modern name but possessing a distinguished genealogy. It traces its ancestry through the E. N. Welch Manufacturing Company to J. C. Brown who established himself in the manufacture of clocks in the Forties and carried on his business under the name of the Forestville Manufacturing Company, later purchased by Elisha N. Welch. Prior to his time all clocks, both 1-day and 8-day, had been of the pendulum type. In 1903 the company was incorporated under its present name and now employs 550 persons and carries on both domestic and export business. The extent to which each of the several clock manufactures of the State has specialized in some particular type or line is of interest. The Sessions Company, for example, has become known particularly for their mahogany tambour scroll clocks with melodious chimes and for their school clocks. They also produce period clocks, reproducing, for example, the "Sharp Gothic" and "Banjo" types of an earlier day. Lever clocks and alarm clocks have also been added to their line.

The H. C. Thompson Clock Company, also of Bristol, is not so well known to the public as some of the other manufacturers since it makes only clock movements and

the name does not appear on the cases, but it is an old concern. It was founded about 1840 by one Chauncey Ives, passing later into the hands of Noah Pomeroy and again in 1878 to H. C. Thompson. The latter eventually formed a stock company and the present name was adopted.

The William L. Gilbert Clock Company of Winsted, is also a sound and prosperous concern, producing various types of timepieces.

In passing from the clock industry to that of watches a natural connecting link is the great Waterbury Clock Company, which is the largest manufacturer of timepieces in the State, and a producer of both clocks and watches. Although a distinct corporate entity under wholly independent management, it is closely allied in family connections and financial affiliations with the great Chase interests, of the same city, which are treated in the chapter dealing with brass industries. The Waterbury Clock Company was organized in 1857 as a branch of the Benedict & Burnham Manufacturing Company, and occupied one of the buildings of the Benedict & Burnham plant on South Main Street in Waterbury. In 1864 the property of the Cotton Gin Manufacturing Company was purchased and the manufacture of wooden clock cases was there started and has since been carried on. In 1873 the company purchased the property of the Waterbury Knitting Company on North Elm Street from the receiver of that concern, upon which site the main plant is still located. A. S. Chase, founder of the great Chase group of industries in Waterbury, was heavily interested in this company from its inception. In 1880 Irving H. Chase, his son, now president of the concern, entered its employ as shipping clerk and

Plant of H. C. Thompson Clock Co., Bristol, Conn., 1923

has been the dominant, organizing force in its later development. Another able contributor to the company's progress was H. L. Wade when he entered its employ as secretary in 1871 and remained with the concern successively as treasurer and as president until his death in 1912.

In 1892 an important step was taken by the company by adding to its existing production, then consisting of all varieties of metal and wood case clocks, the manufacture for the Robert H. Ingersoll Company of the famous "Ingersoll Dollar Watch." The Ingersoll concern was in the beginning solely a selling organization, the Waterbury Company manufacturing their entire output. Later the Ingersoll Company acquired two smaller outside concerns, but at no time did the Waterbury Clock Company manufacture less than ninety per cent of its total output. In 1922 the Ingersoll Company failed and the entire business was bought by the manufacturers. Thus the Waterbury Clock Company became the successor of the Waterbury Watch Company, whose checkered and humorous career is sketched later on in this chapter.

The plant of the company now covers 15 acres of land, has 819,350 feet of floor space and gives employment to over 3,500 persons, marketing its products through branch offices located in New York, Chicago, Montreal, San Francisco and London. The Ingersoll watch business is carried on by The Ingersoll Watch Companies as subsidiaries of the Waterbury Clock Company. The output of this huge Waterbury concern is 6,000,000 timepieces per year, or about 20,000 per day. In addition, the company in 1914 established and now operates the first, and practically the only, watch crystal

plant in the country, having complete facilities for the melting and blowing of the glass, as well as the grinding of watch crystals. In addition to supplying the requirements of its subsidiary, the Ingersoll Watch Companies, it supplies numerous other watch case manufacturers of the country. During the war it was the only producer of watch crystals in the United States, and during that period supplied the watch makers of the nation with over 30,000,000 crystals.

Connecticut, first in clocks, both chronologically and in point of production, has never produced watches on the same scale. But here, too, she has borne an interesting part and achieved a prominent place. The earliest Colonial watch makers were more generally jewelers and silversmiths as well, as watches were considered an ornament and mark of wealth and position until well after the Revolution. In watchmaking Thomas Harland of Norwich, the teacher of Eli Terry, was famous. In his first advertisement, issued in 1773, on arriving from England, he announces that he is prepared to make "in the neatest manner and on the most approved principles, horizontal, repeating and plain watches in gold, silver, metal, or covered cases, musical and plain clocks, church clocks, and regulators; he also cuts and finishes watch wheels and fuzees of all sorts and dimensions, neat as in London and at the same price." In 1774 he further advertises that he "has now completed an assortment of warranted watches, viz. horizontal, showing seconds from the center, day of month, skeleton and 8-day watches in gilt, tortoise shell, and plain silver cases." Small wonder he was able to leave his mark on Terry's workmanship! As evidence of his mechanical

versatility he made in 1788 for Norwich Landing a fire engine which was long in use.

Other pioneers in the watch industry were Henry and James F. Pitkin of East Hartford, who in 1834 began to manufacture by hand the "American Lever Watch" in a shop near their father's home. Close by was the small shop where two other brothers were already established in a thriving silverware business. The four brothers soon combined and employed forty workmen, the products being sold principally at the store of the Pitkins near Exchange Corner in Hartford. This is believed to have been the second attempt in the United States to establish watchmaking as an industry, the first being the watch factory of Luther Goddard of Shrewsbury, Massachusetts, where from 1809 to 1815 several hundred watches were made.

Connecticut's most famous contribution to the watchmaking industry was the celebrated "Waterbury Watch." In 1880 there was founded at Waterbury the Waterbury Watch Company, a concern with a unique history. Up to that time watches were still a luxury, the cheapest varieties costing about $12. It remained for this company to put out the first watch within the financial reach of all. The very origin of the company is quaint. At the Centennial Exposition at Philadelphia in 1876 there was an exhibit showing a modern steam engine—or what was at that time a modern engine—and near it in a glass case was displayed a tiny replica, complete in every detail but so minute that three drops of water filled its boiler. It had been constructed under a watchmaker's microscope with jeweler's tools by an obscure jeweler and watch repairer of Worcester, Massachusetts, D. A. A. Buck. The

next year it chanced that Edward A. Locke of Boston, who had been interested for sometime in the possibility of quantity production of a cheap watch, saw the midget engine in Buck's window and was so fascinated by the workmanship and ingenuity it displayed that he entered the shop and interviewed the maker, outlining his ambitions. For $100 Buck agreed to study the problem and try to invent such a timepiece. After intensive study he finally submitted a model which was not successful. Disheartened by his failure, he fell ill but while convalescing planned an entirely different design which became the "Waterbury" of history, so called because Locke and his associates secured capital and factory space from the Benedict and Burnham Manufacturing Company of that city. After the usual discouragements in securing capital and perfecting machinery, the company was incorporated. The manufacturers at last produced the first thousand watches only to discover that they would not run because of a defect in the sheets of brass used in stamping out the wheels. After more study and expense, a type of watch was made, only about 10% of which refused to run, and the product was ready for the market!

The mechanism was entirely different from any previous type, the works revolving inside the case every hour, carrying with them the hour hand. The mainspring was coiled around the outside of the movement so that the case formed a barrel and was wound by the stem. It had but 58 parts, kept fair time, and was sold for $4, as great a surprise to the world as when Jerome's clock went on the market for a similar sum. The nine feet of mainspring required unlimited winding, and this was the feature that contributed to the product

Waterbury Clock Company, Waterbury, Conn.
Owners of Ingersoll Watch Company

its element of humor. It became a stock minstrel joke —"We come from Waterbury, the land of the eternal spring." More humor was added by the fact that the watch was marketed in a freakish manner. Its cheapness and initial success created such a sensation that Sam Lloyd, the famous "puzzleman," devised a plan whereby merchants could use the watch as a premium or advertising scheme. "Lloyd's puzzles," printed on cards, were distributed by enterprising clothing merchants with an announcement that successful contestants in the guessing contests were privileged to buy a suit of clothes and get with it, free of charge, a Waterbury watch. Thus many men can well remember the joy with which they received their first watch, along with their first pair of long trousers.

There is a story—perhaps of questionable authenticity—of the owner of a "Waterbury" travelling in a sleeping car and, after winding his watch until his arm ached, passing it to a stranger saying, "Here, you wind this a while," with the result that the stranger placed a large order for the watches to be sold by his agency in China. The watch became world-famous and attained a large sale for its day; but, mainly on account of the unsound distribution system, it ultimately failed. The puzzle scheme had spread through the United States, Europe and even China like wild fire, but finally lost its novelty and flagged. The Waterbury watch had made the fortune of clothiers at the expense of its own dignity, and became a by-word for merchandizing tricks—"shoddy at all-wool prices." When the manufacturers at last returned to the regular trade channels they found them closed. People refused to buy a Waterbury because cheap stores had made a

practice of giving them away. Moreover, regular dealers cut prices to get rid of the stock and further demoralizing the selling. Finally the unpopular name was abandoned and the company reorganized as "The New England Watch Company" and made certain "fancy models," which never achieved a secure footing. In 1914 the company was bought at a receiver's sale by the Ingersoll Watch Company of Trenton, New Jersey, which, in the meantime through the manufacturing agency of the Waterbury Clock Company, had carried to a successful realization the original dream of the founders of the Waterbury Watch Company: the making and marketing of a cheap, reliable watch.

In spite of the comedy of its career, the Waterbury watch had contributed to "the democratizing of time telling." The time had arrived and the world advanced to a period when to know the time of day was a vital part of civilization. Train schedules, factory labor, the spread of universal education, the growing importance of organized business with routine hours and definite appointments, called for a watch in every pocket. The Ingersolls, by 1919, were marketing 20,000 watches a day. Over-expansion during the war and the subsequent general slump in industries sent Robert H. Ingersoll and Brothers into a receivership, and, by a fitting trick of fate, the business was bought by the Waterbury Clock Company, lineal descendent of the Benedict and Burham Company which had housed and lent a helping hand to the first cheap-watch concern.

The great Waltham Watch Company, at Waltham, Massachusetts, can also trace its genealogy back to Connecticut along two lines. We have already seen that the Pitkin Brothers of East Hartford had established

a manufacturing plant in 1834, producing the "American Lever Watch." This business was later moved to New York, and Nelson Pitkin Stratton, who learned the trade of watchmaking in this factory, became one of the organizers of the Waltham concern. The other obligation which the great Massachusetts company owes to Connecticut came through the observation of Aaron L. Denison, an expert watch repairer and assembler of Boston, of Eli Whitney's factory system of manufacture where it had been installed at the Springfield arsenal. Denison was so struck with the possibilities of applying this system to watchmaking, that he constructed a cardboard model of a factory organized on that plan. He became acquainted with Edward Howard, who had been entertaining a similar dream of perfected watchmaking, and the two, along with Stratton, interested Samuel Curtis in the project, who backed them to the extent of $20,000. Thus the business was established at Waltham. Denison and Howard had to invent the machinery, build and install their inventions, and work out every process from its beginning. At that time there was no one in this country who undertook watch gilding, or could make dials or jewels, and these problems had to be solved by the ambitious young manufacturers. Unfortunately, as they were on the verge of success, the panic of 1857 drove the company into bankruptcy, but the founders later carried other concerns to success.

Most, if not all, of the leading clock manufacturers of Connecticut now manufacture watches to some extent. The output of the Waterbury Clock Company is, as we have seen, on a very large scale. From 1884 to 1914 the Seth Thomas Clock Company produced

watches to some extent. A line has also been produced by the New Haven Clock Company. In 1912 The E. Ingraham Company of Bristol, having purchased the business of the Bannatyne Watch Company of Waterbury, began the manufacture of watches.

We have thus completed the span of approximately a century and a half during which Connecticut invention, business ability, and honesty of construction have given to the world their invaluable contribution to orderly living. Few chapters in the industrial history of the State present so many dramatic and entertaining features, or typify more completely the genius of its people.

BRASS PRODUCTS

THE group of industries covered in this chapter represents Connecticut's most distinctive and characteristic accomplishment in the field of manufacture. While the State has achieved a noteworthy position in the production of firearms, builder's hardware, hats, silk, malleable iron, and other lines, its reputation in the manufacture of brass goods and kindred commodities has become international. By a chain of events of dramatic interest these have been largely localized in the Naugatuck Valley, Waterbury being the center.

In 1684 there was purchased from the Indians a tract of land eighteen by ten miles in area destined to include Waterbury, Watertown, Plymouth and parts of Middlebury, Wolcott, Oxford and Prospect. With due gravity and solemnity it was reported to the General Assembly that the new acquisition was "capable of supporting 30 families." This inhospitable tract where the Naugatuck River has eroded its passage through the hilly plateau, has become one of the most famous industrial areas in the world, supporting today a population of more than 140,000.

This development came about through the simple agency of man's vanity. Here were made those Colonial buckles and buttons which were an indispensible article of the toilet of every Colonial gentleman. Made at first on a household scale, they were the seeds from which grew the huge plants that now cover the hillsides and fill the river valley. A group of men of indomitable

courage and rare ingenuity embraced a series of opportunities and founded the industries.

This marvellous growth was brought about to a large extent through the importation of English machinery and skilled labor. "Imported" is indeed too dignified and commonplace a word. It was literally filched from under the noses of the British metal manufacturers of Birmingham by what they must have termed in their day "slick Yankee tricks." Success was realized from these conditions by such founders as the Scovill Brothers, the Coes, father and son, and Israel Holmes, and it was done in the face of such obstacles as adverse parliamentary laws and ignorance of contemporary machinery and processes.

As early as 1750 John Allen had established a brass factory in Waterbury and was making brass buttons, and knee and shoe buckles. At about the same time Joseph Hopkins, a silversmith, was specializing in making the same articles of silver. Even the brass products were sold for ten shillings or more for a pair of buckles and buttons were two shillings apiece; and there is evidence that this earliest trade prospered. After the Revolution pewter buttons came to be widely used by poorer people, and in 1790 Henry Grilley, together with his two brothers, who had learned the process from an Englishman in Boston, began to make pewter buttons in his home in Waterbury. The pewter was cast in a mould with the eye in a solid piece and finished by hand, but the Grilleys soon improved this tedious detail by inserting an eye of iron wire. Shortly after this improvement Abel and Levi Porter came to Waterbury with a knowledge of English sheet brass methods and associated themselves with the Gril-

leys under the firm name of Abel Porter & Company, the parent company of the great Scovill plant.

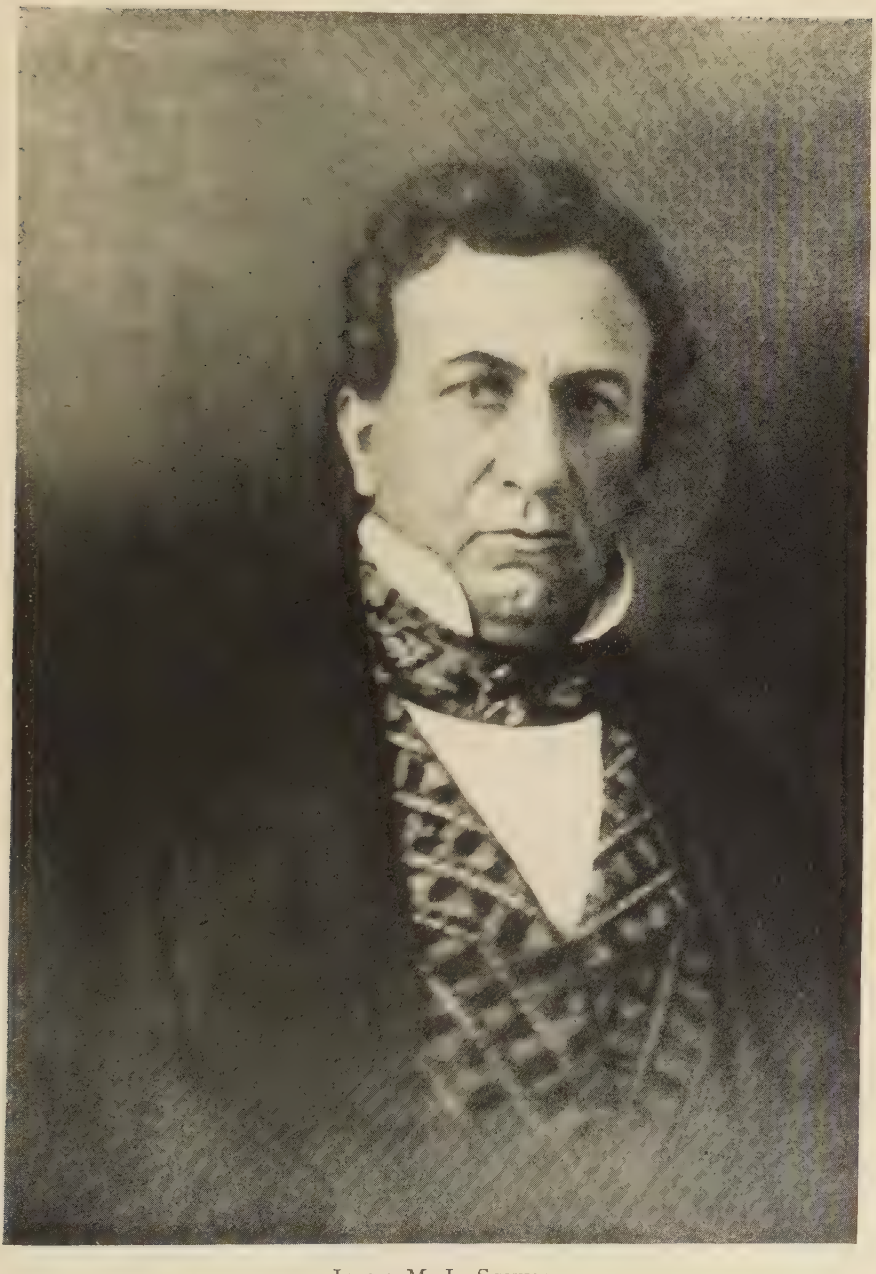
The little company, still located in a private dwelling, began the manufacture of buttons from sheet brass. Apparently they were the first in America to make use of the modern method of making brass by the direct fusion of copper and zinc, which had been invented in England within the past twenty years. The process involved rolling their own brass—also the first process of its kind in America (1802). Previously brass had usually been imported from the Mother Country. The Porters bought old copper such as worn-out kettles and stills, added zinc imported from England and cast the alloy into ingots. The ingots were sent to an iron mill in Litchfield, about thirty miles away, where they were rolled into sheets. This substitution of sheets for castings marked a great improvement, as under the old method the pieces had to be cast, turned, polished, or laboriously hammered to the desired thickness. How it all links up together—Simsbury copper and Litchfield iron works ready at hand for the foundation of the brass industry! Porter's rolled brass was brought back to Waterbury and finished on two-inch rolls. Forms were struck by dies from these sheets and worked by hand-work into buttons, the faces being then gilded and the product sold from house to house or from the peddler's pack. The rolls were operated by horsepower and the entire personnel of the works was but 13, including the four proprietors. In those days the owners were workmen and all were "fellow servants."

This cumbersome procedure was followed until 1808, when their success encouraged them to buy an old grist mill provided with the needed water power. First a

button shop was built and somewhat later a rolling mill of their own. Thus the plant became self sufficient. It remained until 1823 the only consistent effort in the United States to roll brass. The brisk demand for brass buttons for military and other uniforms made their business good. Previously most of these had been imported from England where the industry had been well established and the possession of many valuable trade secrets had kept young industries in the New World at a disadvantage. Particularly was this true in the matter of gilding the buttons, which the English could accomplish with three pence worth of gold for a gross against the three dollars worth required by the Waterbury concern.

At this critical juncture several fortunate occurrences took place. In 1811 James M. L. Scovill entered the firm as junior partner and as President, raised the company from a struggling concern to one of the foremost in the country. A little later one Daniel Hayden, destined to invent machines and processes of immeasurable value to the entire industry, hired rooms in the factory, and began to diversify the product with lamps and other brass articles—one of his earliest important inventions being a machine to cover buttons with cloth, thereby greatly enlarging the scope of the button business. In 1820 the company was so fortunate as to secure the services of an expert English workman, James Croft, who brought a knowledge of the most improved Birmingham processes and to whose skill and inspiration the domiciling of the brass industry in the Naugatuck Valley is largely due. Croft insisted on English methods and English tools, inducing an expert toolmaker to join him in the new country. They had su-

A PIONEER IN THE BRASS INDUSTRY



James M. L. Scovill
Waterbury
1789–1857

THREE STAGES IN THE DEVELOPMENT OF A WATERBURY INDUSTRY

Plant of J. M. L. and W. H. Scovill in 1835

Scovill Manufacturing Company in 1858

Scovill Manufacturing Company in 1871

perior stones for lathe burnishing, the possession of which assured the company of improved technique. One of the first things Croft did was to abolish the expensive button gilding process and substitute the cheaper method.

Under these advantages of skill and personnel, the business grew apace. A New Haven newspaper of 1823 refers to the remarkable production of "20 gross of gilt buttons a day" (the present rate is 70 gross per minute). In 1824 the company made a set of gold buttons stamped with the profile of Lafayette and presented them to the French hero on the occasion of his second visit. Buttons were no longer sold from door to door, but were sent into the open market in direct competition with the English product. Peddlers sold them as far north as Canada and as far west as the Mississippi. A grisly proof of the popularity of Scovill buttons in the far West is the possession of an Indian war club found there about the middle of the last century ornamented with a scalp lock, into which was braided several buttons bearing the company's mark.

Meanwhile, stimulated by the object lesson of these successes, Aaron Benedict, who had established himself in the manufacture of bone and ivory buttons in the town, associated himself with four others, and with a capital of $6500 formed the A. Benedict Company—later the famous firm of Benedict & Burnham Manufacturing Company, (1823) lineal ancestor of the American Brass Company, and the great Chase group. Here, too, is to be seen the hand of James Croft, who with the toolmaker Samuel Forest had a small interest in the new concern and, along with the four proprietors, formed its working staff. At first they, too, sent their

brass to Litchfield to be rolled, but prosperity attending their undertaking, they sent Croft to England where he purchased a pair of steel rollers for rolling brass. They were thirty inches long and eleven inches in diameter, the largest ever set up in the country. This enabled the Benedict Company not only to turn out all of their own brass but furnish sheet brass to other manufacturers. Other new brass companies were being formed by men whose names are now synonomous with the industry and Waterbury was firmly established as a brass center. The household stage had passed into history. Horsepower had given way to water power, and veritable "factories" were erected. There was even some division of labor, the rolling of brass, operating of dies and other processes being distinct operations. Old reports show that in 1820 twenty was the maximum number of employees. About 200 tons of copper and brass were used in the country that year, of which about one-sixth was used in Connecticut. Wood was plentiful for fuel, as was water power for the need.

A notable and heroic figure of the period was Israel Holmes. A native of Waterbury, as were all the founders of the industry except Hayden, he had been in the employ of the Scovills, but sensing the fact that there was opportunity for a new venture he organized the first of the many brass companies of which he was founder. With an associated capital of $8,000, he began the manufacture, under the firm name of Holmes & Hotchkiss, not of a particular article, but of sheet metal and wire for the market. Workmen and more elaborate machinery than had heretofore been employed were brought in from Birmingham, including a wire drawer and tube maker. This resulted in the first

attempt to draw wire or make tubing in this country. At first, it was difficult to overcome the prejudice in favor of English goods, but slowly the undertaking grew. Its first success was based on manufacturing of hooks and eyes, originally undertaken to use up a surplus of wire. The manufacturing of pins was added—of which more later—and in addition rolled brass butts. The tubing was used for gas piping, first by the New York Gas Company in 1836. Due to changes of personnel the firm name became Brown & Elton. Indeed the founders of the industry, less than a dozen, were constantly changing affiliations and firm names so that, while there was continuity of management and policy, the history appears more confusing than it is.

Still another new concern was formed in 1834 when Israel Coe left his partnership with Benedict and associated himself with Anson G. Phelps of New York and others in a venture destined to be instrumental in founding the manufacturing city of Ansonia. Phelps had made a fortune in importing metals and had faith in the rising brass industry as a field for investment. To this he later devoted himself entirely. The new concern was called Wolcottville Brass Company, being located in Wolcottville, now Torrington, and set out to make brass kettles by the battery process, a method of hammering them into shape from blanks. Up to that time kettles had been of cast brass and the new scheme seemed promising. Technical difficulties in mixture and annealing developed and large sums were spent in importing workmen and investigating English processes. Just as the product was being perfected and a return was beginning to be realized, H. W. Hayden of the Scovill Company invented the process of making kettles by spinning

and turning which is still in use. It brought disaster to the Wolcottville venture, and after a few years of idleness the plant was purchased by the Coe Brass Company for a wire-drawing and rolling mill.

Phelps, meanwhile, had withdrawn from the concern and built a mill at Derby, seventeen miles down the river from Waterbury. Phelps with his ample capital and large knowledge of metals and markets, competed successfully with the earlier concerns up the river. Smith and Phelps, as the firm was styled, called their settlement "Birmingham" and, securing English machinery, manned their plant with British workmen. They made a specialty of copper sheets and wire and soon became very prosperous. At this point occurred one of those freaks of fortune which often change the course of history. Phelps formed plans to found on the site an industrial settlement, and to this end started in to buy land. An over-clever speculator, who held a farm considered necessary to the realization of Phelps' project, held out for an exorbitant figure. Yankee avarice and Saxon stubbornness locked horns, and Derby was the loser. Phelps refused to be mulcted and, moving two miles up the river, founded "Ansonia"—so called from his Christian name. Later, the Derby project was abandoned and all of the Phelps interests centered in the Ansonia Brass & Copper Company, which, at the time of its combining with the American Brass Company in 1889, was one of the largest concerns in the industry.

The three Waterbury establishments—Leavenworth, Hayden & Scovill, Benedict & Burnham, and Brown & Elton—with the Wolcottville and Derby mills, were the only enduring ventures in the brass industry up to

SCOVILL MANUFACTURING COMPANY, WATERBURY

West Plant in 1918, on site of original factory, showing Rolling and Wire Mills in foreground and at the left, and Manufacturing Department in the background and at the right

SCOVILL MANUFACTURING COMPANY, WATERBURY—EAST PLANT, BUILT DURING THE WORLD WAR

Section of East Plant, showing Power House, Casting Shop, and Rod and Tube Mills

Section of East Plant, showing corner of Rod Mill at the left, Screw and Rivet Department at the right, and Salvage Department in background

1840, the Ansonia company being founded soon after. These are believed to have been the only establishments in the country at that time mixing and working sheet brass.

Israel Holmes, already mentioned as being connected with the founding of several big concerns, and who later served as President of the Waterbury Manufacturing Company which he founded, made in those earlier days three trips to Europe—full of adventure—in a quest for men, machinery and methods. It should be borne in mind that these earlier manufacturers were, after all, ignorant of many of the secrets of the brass industry. They had been guided largely by Croft's unerring faith and the assurance that in brass manufacturing there was money. They would, therefore, make brass! In the meantime, the English manufacturers, jealous of America's rising industries, exerted their influence upon Parliament for the passage of laws forbidding the exportation of machinery and models, the carrying or sending out of the country of plans, or the enticing of workmen from the Island. Yet, by hook or by crook, they were secured. Sometimes these imported workmen were not the best sort of an investment. Indeed one of them brought over by Holmes & Hotchkiss in 1831 proved so untrustworthy and incorrigible that his passage back was promptly paid by the company to prevent his employment by a competitor. Moreover the English workmen often refused to instruct native apprentices, the first wire drawers for Holmes & Hotchkiss even refusing to permit workmen near their benches. The kettlemen at Wolcottville demanded a separate building, which no Yankee might enter.

On Holmes' first visit to England in 1822, so excessive was the price he offered for machinery that the manufacturers secured permission for him to export it. Workmen he rounded up with great care and secrecy, to the number of about twenty families, and smuggled them out of England and into Waterbury. Tradition has it that these mechanics as well as those later secured were surreptitiously conveyed to the ship in water casks, and that when the voyage was completed and the ship docked at the mouth of the Naugatuck on Long Island Sound, they again crept into the casks and were hauled ashore through the breakers at night and carried up into the foothills of the Berkshires. By the time Holmes had made his third raid, the English manufacturers were thoroughly aroused, and their vigilance increased, but his craft and determination were indomitable and he gathered together and smuggled into Connecticut—landing them at Hartford on this occasion—a company of 38, including the workmens' families. This is said to have been the largest number to elude British vigilance at one time. Coe also made other trips abroad, one even to Germany, to study processes and machinery.

The Waterbury Brass Company when founded by Holmes in 1846 was the largest brass mill in the United States, its dimensions being about 100 x 100 ft. The company bought from Hayden his newly invented process for spinning kettles and shortly dominated the manufacture of kettles for the nation. It also had many other interests, and within a year or two additional buildings were erected. In 1853, with Holmes again the central figure, was established the firm of Holmes, Booth & Hayden. This company secured the services of a

Frenchman, who had been in the employ of Da Guerre, inventor of the daguerreotype, and began to manufacture plates for the new "portrait machine." This manufacture was also taken up by many of the other concerns, but was first introduced by Holmes' company. They also carried on an extensive manufacture of brass lamps, and fittings. The business grew rapidly both in volume and diversity of products, and, when it incorporated with the American Brass Company, ranked third in the United States in size.

These predominant concerns, together with others of lesser magnitude which sprung up in the Naugatuck Valley in mid century, largely owed their successes, and doubtless in many instances their entire existence, to the clock industry of Bristol and Thomaston, the silver plating industries of Meriden and Wallingford and the tin and hardware manufacturies of New Britain, which are severally treated in their appropriate chapters. So, too, did the growing pin manufacture and the production of plates for daguerreotypes furnish an outlet for their product. Especially opportune was the advent of the brass clock manufacture, which occurred at about the time when the brass output seemed to be outgrowing its normal demand. As a matter of fact, several Waterbury manufacturers in 1850 joined hands with the clock interests and formed the Bristol Brass & Clock Company. This movement was headed by the indefatigable Israel Holmes.

In looking back upon these interdependent growths of industry it is difficult to differentiate cause from effect. Whether the brass clock industry owed its successes to the brass industry or the brass industry to the clock industry is a matter of speculation. The fact is

that the two grew up together. The same is true of the relationship between the brass industry and pin manufacture. It was a case of interlocking interests—a circle of skill inspiring production and production developing skill.

There was also intelligent vigilance with respect to political agencies. Alexander Hamilton had urged a 7½ per cent ad valorem duty for the protection of brass manufacture—or even as high as 10 per cent. Throughout the early decades of the century the industry usually enjoyed protection. A provision in the tariff of 1833 would have admitted unmanufactured articles free of duty, sheet brass and wire being thus classified. Waterbury was so alarmed that Israel Holmes and Israel Coe were again called upon to exercise their persuasive powers. They went at once to Washington, but found it too late to effect a change in the bill. A special measure was introduced, however, which accomplished the desired result and was passed during almost the last hour of the expiring Congress.

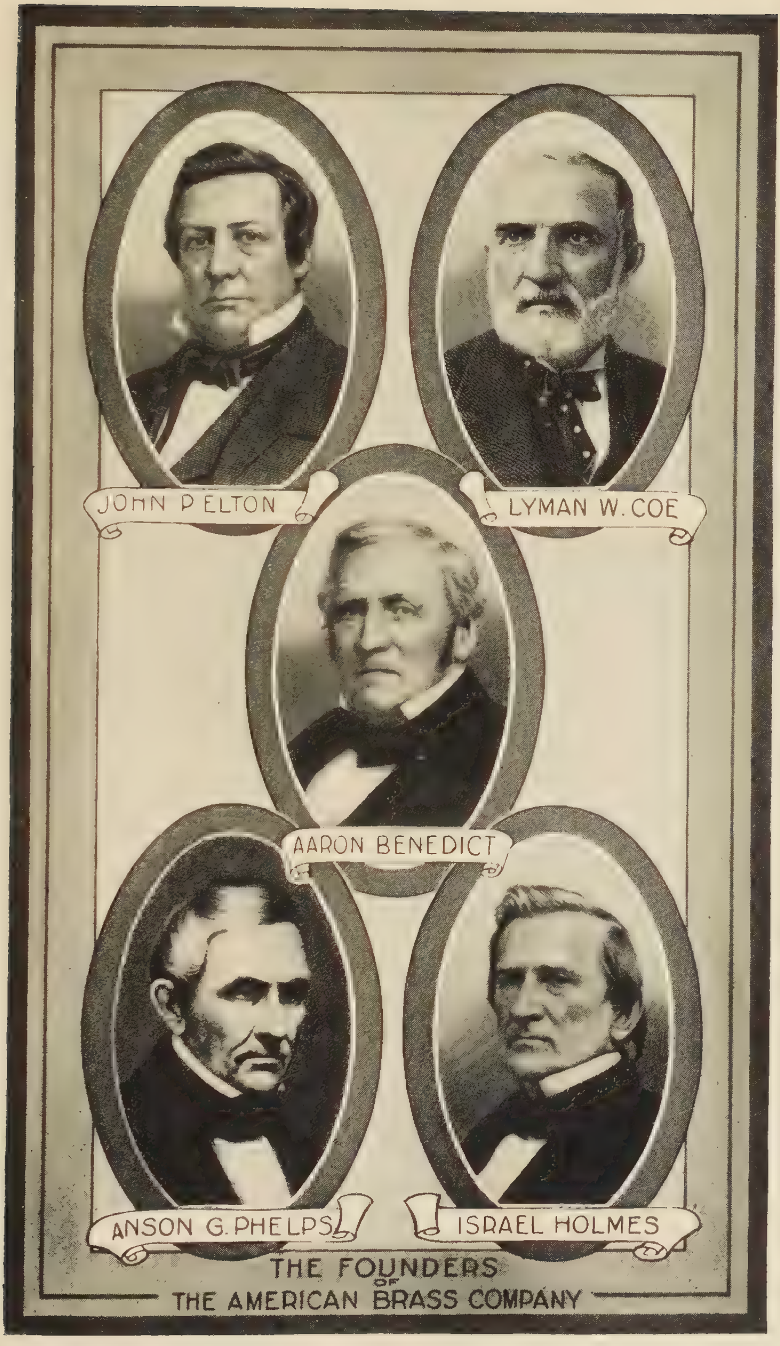
Another evidence of the foresight and catholic vision of this group of organizers was the part they played in the development of the Lake Superior copper mines. With the expansion of their business at about the middle of the century, the need for raw material became insistent. Copper and zinc were imported from abroad in the form of pigs, but the Naugatuck Valley manufacturers desired to be independent of alien supply. The product of the Simsbury copper mine had become wholly inadequate, for reasons explained in the opening chapter of this volume. At about this time efforts were being made to exploit the incredibly rich copper deposits around Lake Superior, and Israel Coe of the Wolcott-

ville Brass Company while in Detroit, discussed the news of the discoveries with John R. Grout, who, at his suggestion, later came to Waterbury and interested J. M. L. Scovill and others in a smelting project. A group of the Waterbury brass manufacturers visited the section and, as a result, the Waterbury & Detroit Copper Company was organized, being controlled by Waterbury capital. This company erected the first smelter to handle Lake Superior copper. Later, another smelting company, the Detroit & Lake Superior Copper Company, was formed, also with Waterbury capital. Until after 1870 these companies controlled the smelting of Superior copper, but after that time the mining companies began to make a practice of smelting their own ore and the Waterbury companies were sold.

The extraordinary versatility of this group was also evidenced by their mastery of the complementary art of salesmanship. Indeed, in the earlier stage of their activities they had been their own salesmen. Israel Holmes had sold goods in the South, and was at first in charge of a company store in Waterbury. Of the two Scovill Brothers, one manufactured the product and the other sold it in the markets of New York, Philadelphia, Baltimore, Boston and elsewhere. For a long period the salesmen were an integral part of the executive organization. Israel Coe was taken into his first firm, in recognition of his qualifications in this direction. With the evolution of modern business, this branch of the industry gradually passed into the hands of manufacturer's agents—although at the present time the heads of many of our leading Connecticut industries have graduated from the salesman's field through successive promotions into the president's chair.

But the location of the plants and the growth of the business left still another obstacle to be surmounted; namely, transportation. Freight was being hauled over three routes, (1) by turnpike to New Haven, a distance of 22 miles, (2) by road to Derby, a distance of 17 miles, where there was connection by boat for New York and (3) by road to Hartford, a distance of 30 miles, and thence by boat down the Connecticut River, or further inland by highway. The conditions for teaming were fairly good in summer, but in the winter and spring it was usually difficult, the roads being at times impassable. It seems strange that the resourceful Anson Phelps in Derby did not push his advantage over the Waterbury manufacturers, situated as he was at the head of navigation on the Housatonic. But at this opportune moment, he was engrossed with his angry transfer to Ansonia and the opportunity passed. Again it was Israel Holmes who solved the problem—seconded by Benedict, Scovill, the Coes and the other familiar figures. A railroad from tide water at Bridgeport was chartered in 1845. The first plans only contemplated Waterbury as a terminus, but the line was later extended to Winsted. Capital to the amount of $1,200,000 was raised and the road built. The projectors did not dream of possible profit from the undertaking, but built it from stern necessity. In the end, however, it became a profitable line.

We now have traced the general course of the Naugatuck Valley brass industry up to about the middle of the last century and left it on the threshold of the new era of massive combinations and modern "big business." The rest of the story may best be told by sketching the


JOHN P ELTON
LYMAN W. COE
AARON BENEDICT
ANSON G. PHELPS
ISRAEL HOLMES
THE FOUNDERS
OF
THE AMERICAN BRASS COMPANY


ANSONIA BRASS AND COPPER CO. - 1858
BENEDICT AND BURNHAM MFG. CO. - 1858
COE BRASS CO. - 1864
A GROUPING FROM
OLD ENGRAVINGS
WATERBURY BRASS CO. - 1858
EAST MILL - WATERBURY BRASS CO - 1858
HOLMES, BOOTH, AND HAYDENS - 1858
THE WATER WHEELS OF THE OLD WATERBURY BRASS CO. AS THEY APPEAR TODAY

careers of the three predominant concerns whose names have now become household words.

In our account the Scovill Manufacturing Company was left in the mid century just beginning the manufacture of daguerreotype plates. Their success in this field is mentioned in an early volume. "They produced" it is said, "a lighter and handsomer plate than the English makers and fully equal to the best made by the French." With the increasing interest in photographic plates, other products of an allied nature were added, with great financial rewards as the development of small cameras for amateur use was then in progress. This development however tended later toward non-metallic materials, and in 1889 the business was set off from the Scovill Company proper and taken over by the Scovill & Adams Company of New York. This became one of the leading camera manufacturing concerns in America and was eventually consolidated with the E. & H. T. Anthony Company under the name of Anthony & Scovill, direct predecessors of the "Ansco Company," whose trademark is now one of the most widely known.

When the German silver industry developed, the Scovills also entered that field, adding at the same time to their list of products the plating of copper with gold, silver or platinum for various purposes. At this period, too, they began the manufacture of brass lamps. The popularity of kerosene oil for illumination was then spreading and one of their products, the "Queen Ann burner" is still a standard. In this they were subject to the infectious influence of the locality. It was in 1807 that the first whale-oil brass lamp was made in Waterbury, and these articles continued to be made there in small quantities and sold in country districts by peddlers.

But with the general use of petroleum, the business grew to an important volume, H. W. Hayden and Lewis J. Atwood being particularly active in this branch.

Another interesting product of the Scovill line has been the coins and medals which they made as early as 1834. At that time their coins were mainly of copper and passed freely as money. Until the Government restricted the issue of such coins in 1842, the company had made over 200 designs. Since then it has frequently supplied the United States mint with copper and nickel blanks, in 1866 furnishing those for the 3 cent pieces now cherished by collectors. It produced the 23,757 medals awarded by the Columbian Exposition in 1893 and has supplied coins and medals to several South American and European countries.

In 1903 the corporation absorbed the plant of the Mathews and Willard Manufacturing Company, one of the older Waterbury concerns established in 1848, and engaged in manufacturing saddlery hardware and carriage trimmings. During the Spanish-American War the Scovill Company secured some war contracts which were responsible for arousing their interest in munitions, making brass shells for rifles and shell cases, as well as loaded and assembled shrapnel shells. This gave an experience in working with powder, destined to be of immeasurable value in a greater emergency. From the Spanish War to the World War the Scovill Company had various similar government contracts, one of the largest of several thousand combination time and percussion fuses, from 1905 to 1907. The manufacture of fuses being a particularly delicate and hazardous undertaking, the company experienced great pride when they reached a capacity of 85 fuses per day, although not more than a

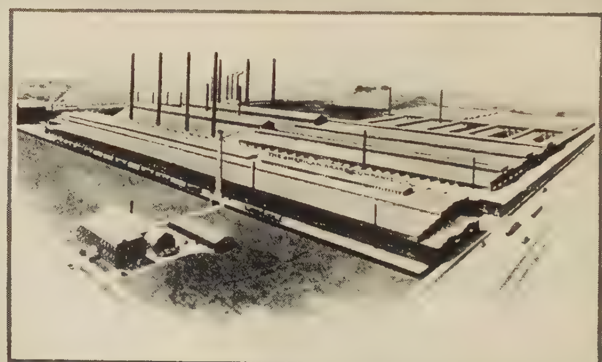
WATERBURY BRANCH, SOUTH PLANT, WATERBURY, CONN.

TORRINGTON BRANCH, TORRINGTON, CONN.

WATERBURY BRANCH, NORTH PLANT, WATERBURY, CONN.

KENOSHA BRANCH, KENOSHA, WIS.

ANSONIA BRANCH, ANSONIA, CONN.



BUFFALO BRANCH, BUFFALO, N.Y.

decade was to pass before they were rushing through 500 times as many.

When the World War broke out in 1914 the Scovill Company at once turned its attention to munitions, and after the entry of the United States into the struggle, devoted practically their entire plant to this purpose. Their production over this four-year period output included:

(1) 21 million time and combination fuses, including the mixing of percussion powder and loading of primers as well as the blending of mealed powder and its loading under high pressure into the time train rings.
(2) 19½ million complete artillery shell cases.
(3) 4½ million percussion fuses completely assembled.
(4) 2 billion brass cups for cartridge shells.
(5) 443 million cupro-nickel cups for bullet jackets.

The present capital and surplus of the Scovill Company is $28,500,000 (including reserve), with capacity for 10,000 employees, a ground area of 168 acres, a floor area of 2½ million square feet, and the annual business $35,000,000. It is regarded as the largest *single* brass making and brass fabricating plant in the world.

The diversification of its products is striking. The company specializes in certain exacting products, such as its special spring bronze, platers' bars for jewelers, reflector brass, high speed free turning rod, improved muntz condenser tubing. Among the products regularly manufactured and carried in stock are various types of machine and cap screws and rivets; uniform and dress buttons and fasteners of every type and description; butts and hinges, wire buckles, other miscellaneous articles, among them sewing thimbles which

may be turned out at the rate of 4000 per hour. A large number of other articles are made to order for other companies: gas burners and parts of electric wiring devices at the rate of 8000 pieces per hour; electrical motors for household electrical devices, including vacuum cleaner motors at the rate of 40 per hour; spring motors; valves, particularly radiator valves at the rate of 3000 per day; toilet novelties and containers of every sort; blanks for clock and watch parts; bicycle and automobile parts; caps, shells, coins, and medals; screw machine products; munitions; brass and aluminum castings. That even this imposing list is far from comprehensive is shown by the company's estimate that for the last sixty years an average of about 100 new articles have been added to the output annually.

In 1923 the Scovill Manufacturing Company purchased two great pin manufacturing concerns which for years had practically dominated the market, the American Pin Company and Oakville Company—both Waterbury concerns dating from the mid century. These are described in detail under pin manufacturing in this chapter.

Connecticut's largest manufacturing corporation, The American Brass Company, which in 1922 merged in the Anaconda Copper Mining Company, represents a more or less characteristic tendency of modern business. In Connecticut, old concerns under family names and largely under family management have shown great vitality. Such concerns as Cheney Brothers, manufacturers of silk, the Chase Companies of Waterbury which will be discussed shortly, R. Wallace & Sons, silver manufacturers of Meriden, Sargent & Company of New Haven, Seth Thomas Clock Company of Thomaston,

CHARLES F. BROOKER

Who has long been prominent in manufacturing, financial and political circles, was born in what is now Torrington March 4, 1847. In 1864 he became bookkeeper for Coe Brass Company of Torrington, his uncle Lyman W. Coe having devoted his life to founding that corporation and making it a success. At his uncle's death in 1893 Mr. Brooker became president of the company. In 1900 the American Brass Company was organized as a consolidation of five great brass companies and of this aggregation Mr. Brooker was chosen President. Mr. Brooker's home is in Ansonia. In 1894 he married Mrs. Julia E. Clarke Farrell in London, Eng. Mr. Brooker entered active politics in 1875 when he became a member of the Connecticut House; later he was a state senator; went to the Columbian Exposition at Chicago as Connecticut Commissioner, and for years was a member of the Republican state central committee and of the Republican national committee. Yale gave him an honorary Master of Arts in 1911.

Chas F. Brooker

and the Yale-Towne Manufacturing Company of Stamford are typical of this class. In the case of others such as the Scovill Manufacturing Company, the American Hardware Company of New Britain and the International Silver Company of Meriden, financial control has been maintained by Connecticut capital. The merger, however, of the American Brass Company with the Anaconda Copper Mining Company represent that stage of industrial development which produces companies of interstate scope. Several similar illustrations might be drawn from active Connecticut concerns, conspicuous among which would be the rubber group, controlled by the United States Rubber Company, and the large thread interests of Willimantic, which are controlled by the American Thread Company. In a considerable number of such instances of foreign control, the active management has still remained in the hands of the Connecticut personnel which had built up the business. This is still true of the American Brass Company, John A. Coe being its president and Charles F. Brooker chairman of its Board of Directors.

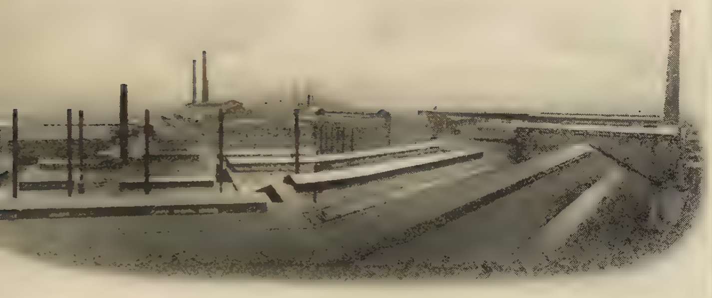
The American Brass Company was organized in 1899 and constituted an amalgamation of several other brass manufacturers of the locality—comprising the Waterbury group, the Torrington group and the Ansonia group. The career of these companies has been already described. The Coe Brass Company had also acquired the Chicago Brass Company of Kenosha, Wisconsin, which had been founded by the Waterbury Manufacturing Company in 1886. Between 1890 and 1895 The Coe Brass Company had been operating some of the heaviest machinery in the world used for the rolling of brass and was the most important plant in the country

devoted exclusively to rolling metal and drawing wire, having purchased the plant of Wallace & Sons of Ansonia, famous wire drawers. The Ansonia branch of the American Brass Company leads all others in metal produced and number of employees and is now made up of the plant of Wallace & Sons and the Ansonia Brass & Copper Company.

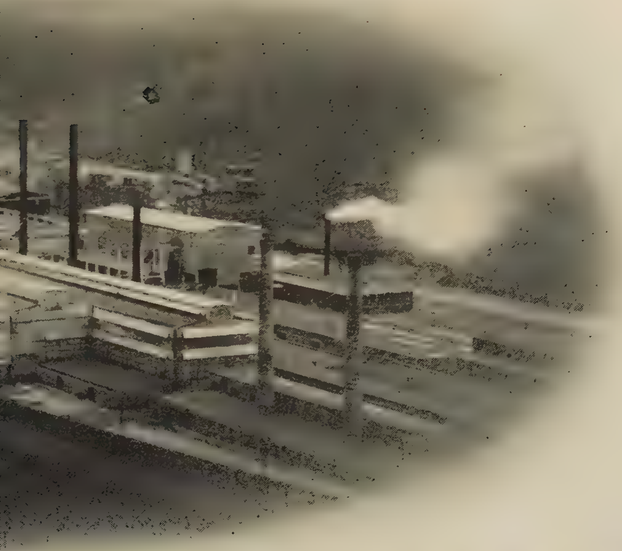
The American Brass Company became the greatest brass organization in the world. Of the eighteen brass mills in the country at the time, eight directly or indirectly made up the final organization. These eight employed nearly half of the 10,000 employees then used in the business. On the basis of metal produced the percentage is said to have been even greater. During the World War the number of employees of the combined companies reached 16,000. In 1917 the Company purchased the Buffalo Copper & Brass Rolling Mill situated at Black Rock, New York, which it enlarged and remodeled. In 1922, at the time of the merger of the American Brass Company, with the Anaconda Copper Mining Company, Brown's Copper & Brass Rolling Mills of New Toronto, Canada, was purchased and is now operated as Anaconda Brass, Ltd. This is the largest brass mill in the Dominion, and was acquired to absorb the rapidly growing Canadian trade.

During the World War the American Brass Company produced an aggregate tonnage of war materials amounting to more than 1,000,000,000 pounds. It consisted of cartridge brass, discs for shell cases, projected bands, brass rods, condenser tubes and other items of sheet metal; also wire, rods and tubes in great variety. At the present time the company turns out over 500,-000,000 pounds of copper yearly including brass prod-

WATERBURY MANUFACTURING COMPANY



CHASE ROLLING MILL



CHASE METAL WORKS

ucts in the form of sheet, wire, rods and tubes. The present number employed in its mills and offices ranges from 12,000 to 13,000. It has markets located everywhere, notable interests being the electrical industry, automotive and domestic appliance industries, such as plated tableware, kitchen utensils, stoves and ranges, washing machines, vacuum cleaners, water heaters, clocks, beds, etc.; together with the building trades, railway and marine construction and repair and the manufacture of metal specialties.

The third of the great Waterbury groups revolves around the name Chase. The parent institution of the Company was the Waterbury Manufacturing Company, which was founded in 1837 as previously noted. Originally it was called "Hitchcocks" and later became known as the "United States Button Company" which betrays the fact that it too, owes its existence to Waterbury's early preëminence in button manufacturing. The United States Button Company manufactured buttons and similar novelties of bone, steel, and brass, meeting with more or less adversity in its career.

In 1876 it passed into the hands of Mr. A. S. Chase and was incorporated under the new name of the Waterbury Manufacturing Company. Mr. Chase was at that time President of Holmes, Booth and Hayden and other Waterbury firms, such as the Smith & Griggs Manufacturing Company, the Waterbury Buckle Company and others. He was the President of the Benedict & Burnham Manufacturing Company during the period when it was the largest brass concern in the city, also of the even more famous Waterbury Watch Company. He was also President of the Waterbury National Bank and was a director of many other business concerns in the town.

Two or three years after Mr. A. S. Chase had bought and formed the Waterbury Manufacturing Company, his son Mr. H. S. Chase, together with Mr. C. F. Pope, went in with him and assumed direct management of the concern, buying out the entire control of the Company. Shortly after this Mr. C. F. Pope sold his interest to Mr. Chase and the concern passed into the complete control of the Chase family.

With Mr. H. S. Chase as its president and with the loyal assistance of his brother, Mr. F. S. Chase, who later became the third President of the Companies, together with Mr. R. J. Ashworth and later Mr. C. F. Henger and others, the company manufactured brass goods exclusively and grew rapidly.

The Waterbury Manufacturing Company bought large quantities of metal which it cast into ingots and had rolled in neighboring brass mills. The expense and delay of farming out its metal grew more burdensome to the young company as it became larger, and in 1900 a mill was built called the Chase Rolling Mill Company to cast and roll the metal needed by the factory. In this way the second unit of the concern came into being and gradually entered the open market as producers of brass, sheet rod, and wire.

Somewhat later with a view to the future of the brass business the company purchased extensive tracts of land in Waterville and in 1911 a second brass mill "Chase Metal Works" was founded.

Eventually these three companies—Waterbury Manufacturing Company, Chase Rolling Mill Company and the Chase Metal Works—were merged into the present Chase Companies, Incorporated, with a capital of $4,000,000, which was later increased to $10,000,000.

AUGUSTUS SABIN CHASE

Of Waterbury, was born in Pomfret August 15, 1828 of original Puritan parents and died in Paris June 7, 1896. He was educated at the Woodstock Academy, going to the Waterbury Bank in 1850. He became assistant cashier in 1852 and president in 1864 continuing such until his death. He was president of the Waterbury Manufacturing Company, of the Benedict & Burnham and the Waterbury Buckle Company as well as of the American Printing Company, publishers of the Waterbury American. He was first treasurer of Waterbury and served on many of the boards of the city taking also great interest in churches and charitable institutions. He served a term in the legislature. Fortunate in a wife of understanding mind and sympathetic heart their children followed closely where he had led. Henry S. Chase first president of The Chase Companies, Inc., at his death in 1918 was succeeded by another son Frederick S. Chase; Irving H. is president of the Waterbury Clock Company; Helen E. is a resident of Waterbury also; Mary Eliza married Arthur Reed Kimball the well known newspaper man and publicist, and Alice Mather is Mrs. Edward C. Streeter of Boston.

A. S. Chase

Twice in its career has the Chase group made extensive changes in the sites on which their factories stand, the first change being when they filled in the lowland for their new Chase Metal Works plant in Waterville from 3 to 10 feet above the highest known water mark of the Naugatuck River, along which the factory was built.

The second change was a little more spectacular. During the period of war expansion the Chase Metal Works decided to enlarge its mills and the only available ground was the then bed of the Naugatuck River. In 1914 the records of the Company bear the following laconic memorandum. "Mr. O'Brien: Please change the location of the Naugatuck River as per enclosed blueprint." Thus does modern business require nature to accommodate itself to its needs.

Some conception of the activities of the manufacturing branch of the concern—that of the Waterbury Manufacturing Company—may be conveyed by the fact that over 33,000 different brass articles have been manufactured there, mostly in large quantities.

The Chase Companies have always remained under the control and direction of the family. Mr. A. S. Chase, the founder and first president of the concern supplied the financial backing, prestige and manufacturing experience to start the newly incorporated company. Mr. H. S. Chase, his son and the second president of the companies, was the expander and active head of the companies from their founding until his death in 1917. Mr. F. S. Chase, his brother, was with him an active manager of the concern and at Mr. Chase's death became its third president. This notable trium-

virate is another instance of the vitality and persistence of family management in Connecticut business institutions.

While the American Brass Company, the Scovill Manufacturing Company and the Chase Companies may seem to dominate the manufacturing situation in this remarkable valley, there are numerous lesser concerns in the locality equally prosperous and influential within the sphere of their operations. Among these is the Plume & Atwood Manufacturing Company, organized in 1869. This concern operates mills in Thomaston and in Waterbury and has become one of the largest of the independent brass manufacturers. Another is the Randolph Clowes Company, successor to other well-known concerns, and prominent makers of brass and copper tubing. To this list of secondary concerns may be added the Smith and Griggs Manufacturing Company of Waterbury, the Seymour Manufacturing Company of Seymour, organized in 1876 and now extensive manufacturers of German silver, brass, metal sheets and copper wire rods, the Farrell Foundry, the American Mills, Waterbury Clock Company, and others.

Examples of the resourcefulness of the group of men who have been responsible for the development of the Naugatuck Valley industries—such as the acquisition of labor and machinery from England, vigilance in watching the tariff, provision for transportation through the construction of a railroad and the establishment of the copper smelting industries in Michigan—have already been recounted. It was here also that was effected what is believed to have been the earliest trade agreement in the United States to be carried out on a large scale. In

MAIN OFFICES CHASE COMPANIES

1853 every brass mill in the valley, together with the Bristol Brass & Clock Company, signed a price agreement. In their struggle to recover from the crisis in 1857 they expanded this agreement so as to cover regulation of production. As a penalty for violation of this agreement, 3 cents was to be paid into a "pool" for every pound of metal handled above its apportionment by any mill; as, likewise, any mill might draw out of the pool a like amount of 3 cents per pound for the production below its apportionment which it had failed to market. This combination maintained a store in New York for marketing. These pools on the whole worked satisfactorily, but were maintained with increasing difficulty owing to conflicting interests and rapid expansion. Until nearly 1900 this group produced more than 90% of the rolled brass in the United States.

Of the more than 250 mills in Waterbury, Naugatuck, Ansonia and Derby at least three-fourths of those of any magnitude belong to the metal classification. The export part of their business has never been of great importance. Their efforts have been directed to endeavoring to fill the ever increasing demand of the United States. There has, however, been some important exportation of brass clock movements. Of course, the greatest factor during recent years in the expansion of their business was the invention of the telegraph, and later of the telephone, both requiring wire of high quality in a volume incredible in the earlier days.

In an account of the Scovill Company, published shortly after the Civil War, there appears this interesting quotation, "The history of the brass business in Waterbury does as much credit to our Yankee force and enterprise as that of any manufacturing interest in

America. Within the memory of living men the little village of Waterbury has been a byword for its poverty. Now it is the fifth city in the State. The change is due to no natural advantage, but solely to the enterprise and energy of a few sturdy men, who with scanty means, engaged in a business new to themselves and to this country and by their own personal ingenuity and industry, aided by judicious protection, without which they could have accomplished nothing, made it successful." Owing to the limitations of space necessary in a volume of this character it has been possible to touch only the outstanding features and give accounts of the more prominent concerns. A more comprehensive account of the industry may be found in a small, but complete and scholarly work, by William G. Lathrop, entitled "The Brass Industry."

An important branch of the brass industry is that of wire making and its kindred department of pin making. As has been pointed out, the beginnings of wire making in the Naugatuck Valley occurred when Brown & Elton secured from England in 1831 six wire blocks, a wire drawer and other new machinery and made the first effort in this country to draw wire. It was not long before this company and others, notably Holmes & Hotchkiss, were producing more wire than the trade at that time could absorb.

Another development along similar lines was founded by Thomas Wallace, who came to this country from England in 1842 with his wife and nine children. He was an expert wire drawer. Finding his way eventually to "Birmingham," now Derby, he worked for some years at his trade with the Howe Manufacturing Company, pin makers; but in 1848 went into business on his

own account in Ansonia. From a little shop 50 by 175 feet, and an even smaller casting shop, with an operating force of 50 men, he turned out sheet metal and wire at the rate of 30,000 pounds per month. Later there was founded a joint stock company—Thomas Wallace & Sons—which flourished until 1891, when it was forced into liquidation during the depression from 1880 to 1887. At this time many plants in the industry operated at a loss. Falling prices and excess of production over consumption brought about this depression. At this time also the old firm of Brown & Brothers failed, the only two failures among the ten firms to enter the industry before the Civil War. As will be seen later, this plant was purchased by the Coe Brass Company and ultimately found its way into The American Brass Company through this avenue.

The pin industry at first was the great user of domestic wire. With the increasing use of machinery, particular wires were needed. The vogue for hoop skirts gave an impetus to the industry and it is interesting to note that the Osborn & Cheeseman Company, established 1866, enjoyed a period of great prosperity in the manufacture of wire hoops for skirts, and another company specialized in hoop skirts and carpet bags. Needless to say both were short lived, the former being finally purchased by the Coe Brass Company. Woven-wire mattresses replacing feather beds were another factor.

The development of pin manufacturing, centering in the Naugatuck Valley and Winsted, is due to inventive genius, coupled with the presence in this vicinity of the brass and wire industry. Until 1800 the manufacture of pins was peculiarly difficult. The head was made of coiled wire and fabricated separately from the shaft, the

manufacture of the couplet pin requiring eighteen separate operations. In the Colonies particularly, pins were costly articles, being almost entirely imported—as indeed they continued to be until about 1830. At the time of the Revolution pins were sold for 7 shillings 6 pence a dozen, and at even earlier dates there were mentioned in wills and inventories "a paper of pinnes" along with other personal belongings. There is a record of the manufacture of pins in Rhode Island, and it is said that even solid-headed pins were made on a small scale in Providence by the time of the Revolution. In 1775 Leonard Chester of Wethersfield, asked the aid of the Legislature to erect a pin factory in that town, but the project was abandoned. A few years later the eccentric Apollos Kinsley, inventor of many remarkable machines, both practical and impractical, produced a device for making pins which was evidently unsuccessful.

In 1824 a machine was invented to make solid lead pins by driving part of the pin into a countersunk hole, a notable advance over the wire head pin. Samuel Wright, an American, invented the machine in England, and in a short time only solid-headed pins were being made in either country. In 1831, however, Dr. John Ireland Howe of Bellevue Hospital, New York, invented a machine which would make a pin in one operation, adding improvements to his invention during the next ten years. During the same period two other inventors were successful with the same problem—Slocum & Jellson of Poughkeepsie, New York, and the Fowler Brothers of Northford, Connecticut.

Of these the Fowler machine was undoubtedly the best. The inventiveness of the Fowler family, marked

through several generations is noteworthy. One Maltby Fowler, who settled in Northford, made the first four-wheel vehicle built in the State. Subsequently he left his coopering trade and began the manufacture of the inevitable buttons of bone, ivory, horn, and wood, keeping four peddlers' carts on the road. Pocket combs and other trifles were later added. Of Maltby Fowler's twelve children, all showed mechanical ingenuity; and two, DeGrasse and Thaddeus, produced astonishingly varied inventions, including a press for perforating tin, a machine for drawing out brass tubing, a screw machine which turned out 6,000 screws per minute, cigar and cigarette making machines which are still in use, a washing machine, and a power press which was manufactured for many years in Middletown, the Fowler horse-nail machinery, a reaper and binder and other smaller or less successful inventions.

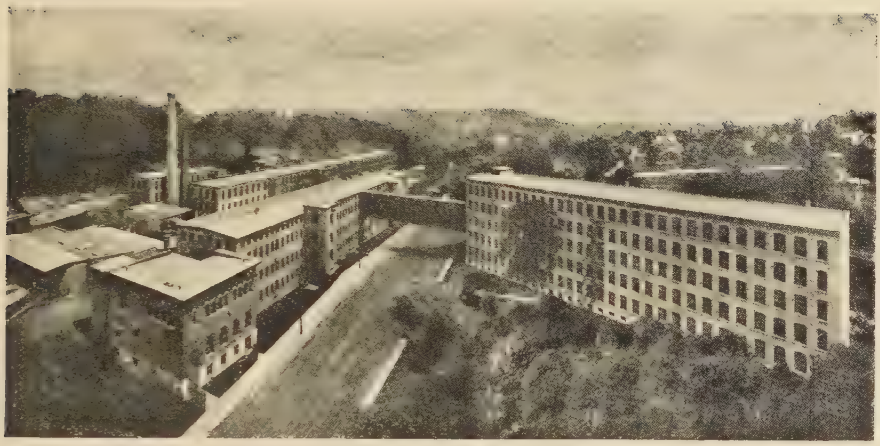
But the most important in this connection, however, are the contributions to pin machinery. Horace Fowler is said to have left a set of dies laid away in the drawer of a tool chest, and from them after his death his son developed the principle of the machine for the production of solid-head pins which was used by them successfully for a considerable time. But the industry finally gravitated to the Naugatuck Valley, when the entire business was later sold to Brown & Elton and moved to Waterbury. In the meantime Dr. Howe, requiring skilled mechanics and urged by Anson Phelps, had also located his enterprise in Derby.

After the solution of the problem of the production of a pin with a satisfactory head made by one process, there remained the further problem of the production of a pin-sticking machine. The success of such a machine was

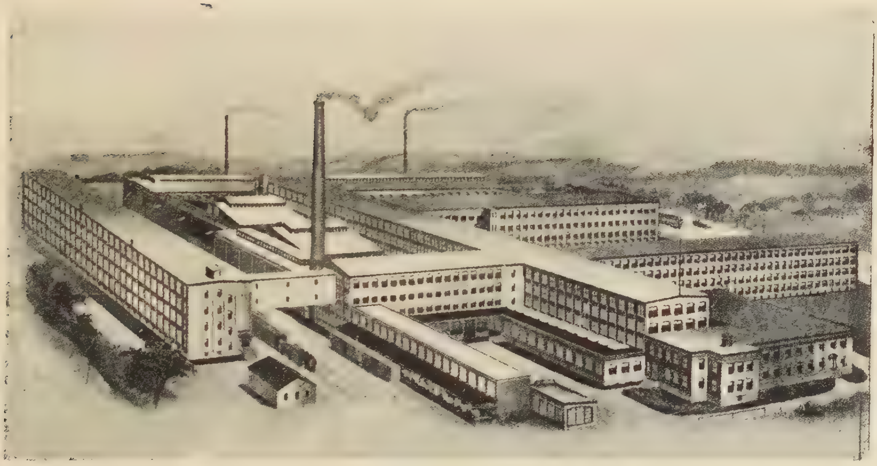
vital to the industry. The tedious process of inserting the pins in papers constituted a large part of the cost of the articles. When Dr. Howe, working with Slocum & Jellson of Poughkeepsie, perfected a pin-sticking machine, these makers secured a great advantage over the Fowlers. Later, Thaddeus Fowler invented three machines of this character, but unfortunately too late for employment in the Fowler factory. These machines gave to the United States control of the pin industry. Without them 90 packs had been filled by 60 female operatives in one day—an aggregate of about 300,000 pins. With them, one woman may pour into a hopper gallons of pins which come out neatly arranged on paper —"a mystery to all save the inventor and no one but the operator is ever permitted to enter the room." The Howe Manufacturing Company carried on a large and profitable business in Derby until 1908, when it was bought out by Plume & Atwood.

After Brown & Elton had bought the Fowler enterprise in 1842 they acquired a third interest in the Slocum & Jellson concern and thereby secured the right to use Howe's pin-sticking machine. Thereafter they began the manufacture of pins on a large scale. In 1846 they arranged with Benedict & Burnham to purchase the remaining two-thirds interest of Slocum & Jellson, and together they organized the American Pin Company.

Induced by the large profits of Howe and the American Pin Company, other companies were formed, but soon failed. As long as the basic patents of these two concerns held, they controlled the American market. In some years the only returns in census reports on pins are from Connecticut. The expiration of patents and the introduction of new inventions, however, eventually



THE AMERICAN PIN COMPANY
Division Scovill Manufacturing Company



OAKVILLE COMPANY IN 1915
Division Scovill Manufacturing Company

turned the attention of the American Pin Company to additional products. Upholstery trimmings and brass and wire novelties were begun in 1885, and brass plumbing goods, bedsprings and gas and electric fittings—now very important—were added later. During the World War the plant manufactured fuse parts and automatic revolver magazines. It has about a thousand employees, 38% of whom are women, and produces both for domestic and export trade. It has 37 four-story buildings and is one of the three plants which manufacture nearly 75% of the national production of pins, safety pins, and hooks and eyes.

The Oakville Company, also of Waterbury, dates from the same period as the American Pin Company and has had a similar development. It is the third of the important trio. It is interesting to note that the original locality of the Oakville Company is in what was a Scovill building—that vacated by Scovill & Buckingham when they merged with the Scovill Manufacturing Company in 1850. It has remained on the same site, now having 17 buildings and nearly 1,000 employees. The American Pin Company and the Oakville Company, representing a combined capital of about $5,500,000, were purchased by the Scovill Manufacturing Company and make that concern the dominant factor in the pin market.

The other pin center of the country is Winsted. The largest of the Winsted concerns is the New England Pin Company. This company was founded in Winsted as the Hartford Pin Company. It was later purchased by Anson G. Phelps, but continued in the same line of manufacturing. Early in its career it encountered litigation with the Howe Pin Company in regard to the

famous sticking machine, but its use was finally permitted by the courts. In 1857 it became the New England Pin Company, and was bought back by Winsted interests. The Union Pin Company is another smaller, but prosperous, Winsted concern.

The Star Pin Company of Derby also manufactures pins, hair pins, and hooks and eyes. It was organized in 1866 and now has about 300 employees. One of the founders of the company, James C. Hubbard, is still connected with the company. He made the wood pattern for the first pin machines used in the plant. These machines are still in daily operation.

While Waterbury has stood unchallenged in her claim as the brass center of the world, and is so today, there has been some overflow of the brass industry from the Naugatuck Valley into other parts of the State, particularly Fairfield County. The most notable instance of this character is the Bridgeport Brass Company. It was organized in 1865 when John Davol and others purchased from the Wilmot and Kissam Manufacturing Company of Brooklyn their real estate, merchandise and other assets. The company first applied itself to the production of brass clock movements, but apparently did not meet with success in this direction and later sold the clock machinery to the Ansonia Brass and Copper Manufacturing Company with the understanding that they would take off the hands of the Ansonia concern, upon terms agreed upon by the presidents of the two companies, the clock parts manufactured. The Davol interests were bought in 1880 by F. A. Mason, who had been connected with Benedict & Burnham for many years. After that the company grew more rapidly. Trade agreements were frequently entered into with the Nau-

gatuck Valley mills on account of the Mason connections in Waterbury.

This company was among the first in the United States, and is believed to have been the first in the country, successfully to establish a plan for employee-representation, having shown for many years a keen interest in labor problems. On its technical side it was the first company to employ successfully electricity for melting brass on a commercial scale. Other contributions of this concern are the "tandem roll stand" and certain improved drawing devices for tube production. Its development of the special electric transmission wire, known as the "Phono-Electric Trolley Wire," was a marked factor in the successful electrification of the New York, New Haven and Hartford Railroad Company, and other transportation lines. At the present time it employs approximately 2,500 workers, and produces about 5% of all the wrought brass made in the country. Its output is marketed abroad to some extent, but chiefly, of course, in the United States. During the war its entire plant was devoted to the production of war material.

From the necessarily limited sketch of the brass industry presented in this chapter, it may be seen what a striking part one valley of the little State of Connecticut has borne during the Industrial Revolution and the century following it. Indeed, this may well be regarded as one of the most impressive phenomena of modern history. It illustrates the supreme truth that the personal element is the determining factor in human progress. The old founders, with their inventive genius, their resourcefulness, their ability to attract and use capital and labor, their grasp upon the correct principles of salesmanship, their solution of the problems of transportation

and of the acquisition of raw material, have here established a civilization of their own. Homes, schools, churches, public utilities, mercantile establishments and amusement enterprises have grown up in the wilderness and constitute a marvellous network of interdependent interests. The cities are their monuments and the history of the cities their obituaries.

TOOLS AND BUILDERS' HARDWARE

IT may be justly claimed that the preëminence of Connecticut in many branches of the metal industries may be traced to the quaint tinware trade which flourished in and around Berlin from 1740 to the Civil War. By this industry of a by-gone age the State was known from one end of the Colonies to the other, the Connecticut tin peddlers penetrating at first on horseback and later with elaborately fitted wagons to the farthest settlements, selling their "Yankee Notions." By their shrewd bargaining they earned for all New England the reputation and attributes, good and bad, which adhere to this day to the term "Yankee." To the success of this tin trade may be traced the development of the tool, builders' hardware, household equipment, and silver and tableware industries in Hartford and New Haven Counties, which in turn later lead to the attraction of machine builders and machine tool makers to the cities where skilled metal workers and marked mechanical ability were to be found.

The first tinware in the Colonies was made by Edward Pattison, a colonist from Ireland, tinsmith by trade, who set up his little shop in Berlin in 1740. The ware was a great curiosity in the neighborhood, its glittering surface contrasting with the dull glow of the pewter utensils in general use at the time. The tin was used for household utensils and flatware and gradually supplanted the more pliant pewter, as witness the reported incident of Washington's visit to a certain Connecticut town. At the Inn the General was furnished a tin fork and spoon, and on his request for silver was told that the house afforded no other ware. Thereupon the fas-

tidious Virginian gave a servant a coin to "run to the minister and borrow a silver spoon." A curious poem written by Emma Hart Willard, a native of Berlin, describing Tabitha North's wedding to Colonel Isaac Lee, a Revolutionary New Britain hero, describes the interest among the housewives in Pattison's innovation. The guests at the wedding cry—

> "Oh, what's that lordly dish so rare,
> "That glitters forth in splendor's glare?
> "Tell us, Miss Norton, is it silver?"
> "Is it from China or Brazil, or—?"
> Then all together on they ran.
> Quoth the good dame, " 'Tis a tin pan,
> "The first made in the colony,
> "The maker, Pattison's jest by,
> "From Ireland in the last ship o'er.
> "You all can buy. He'll soon make more!"

At first Pattison merely supplied his immediate neighbors, but as the popularity of the ware increased he began to employ "peddlers" to carry it into the nearby towns. He kept the lucrative little trade to himself until 1760 when the apprentices to whom he had taught the craft of shaping tin sheet iron into small utensils opened shops of their own in Berlin, Farmington and the other towns about.

The peddlers at first travelled afoot, carrying suspended from their shoulders by a broad strap of parti-colored webbing two large tin trunks, one on either side weighing from 50 to 70 pounds each. So long as the distances were short and the roads remained little more than trails, this method prevailed; but before long the persistent popularity of the ware

and the fact that the wandering vendors supplied a real economic need by bringing to the doors of the isolated and distant farmhouses articles which it was otherwise almost impossible to obtain encouraged the proprietors of the little shops to add other small articles to their line. Scissors, combs, clocks, buttons, brassware, and, later on, paper, hats and other luxuries were added—anything, indeed, that a household needed and which was small enough to be packed in the magical trunks. As the markets widened and the wares became more varied, hand carts were used in the more populous districts; while for reaching more remote fields a trunk was strapped to each side of a horse and another on the rider's back. Thus, like a medieval knight, the peddler would ride forth to conquer new markets.

As the roads improved a special type of wagon was designed for the trade. Strongly built, covered, with open sides to display the samples, and drawn by one or two horses, it jingled through the Colonies, eventually penetrating to Montreal and Quebec, to Charleston and the southern trade, and even across the Mississippi. To the South and West, the drivers of these carts were the original "Yankees"—shrewd because they must be shrewd to bargain, and to sell and re-sell the goods they frequently "took in kind" for their own wares in those pioneer settlements where money was rare. A tin pan or a bone comb or a few pewter buttons would be sold to the housewife for eggs and butter, which might be later turned in to a country storekeeper, perhaps at a slight loss, for English or French money or possibly for furs to be sold again or bargained with in later "deals." Accused of selling basswood hams, white oak cheese and wooden nutmegs, the peddlers may have been sometimes

unscrupulous and played upon the credulity of simple farm folks in lonely outposts of the New World. But on the whole they must have been fair and honest, for the scions of some of the best blood of the Colonies often rode off with tin packs or wagons in those early days, fired with the spirit of adventure as well as the desire for gain. The departure or the return was a town event. The courageous youth, venturing alone into far countries, perhaps even to the Great Lakes, with his glittering van or carefully packed trunks, to return with empty cart and full pockets, bearing all the news of the world outside to the little group of towns in mid-Connecticut stimulated the imagination of people accustomed to a simple life and limited outlook. No peddler could be a coward to travel the wild roads of the time with gold on his person. And at the other end of the line, it is easy to picture the excitement of the arrival of one of these daring travellers at some distant farm—the women of the household crowding about the strange vehicle in their eager quest for scissors, combs and pans, and their coveting of the cheap ornaments which the shrewd Yankees quickly learned were so tempting to lonely women; and the men hurrying in from the fields to hear the news and view the hoes, axes, and other tools which they could get from no other source except the wayside forge. Small wonder that the business was profitable and laid the foundations of some of the more pretentious fortunes of the present day.

The Revolution temporarily suspended the industry by cutting off the importation of tin plate, but it was immediately resumed following the war, and it is said in "Dwight's Travels" that after the close of the War of 1812 "10,000 boxes of tin plate were made into culi-

nary vessels in the town of Berlin in one year," adding that the peddlers "went with their ware into every part of the United States." During the early decades of the nineteenth century the bigger shops sent out—by water usually—to Montreal, Richmond, Charleston, and Albany, a few workmen and some raw materials. These workmen spent the winters in the distant centers making up the tin. In the spring the loaded wagons were sent out from the Berlin base, covering carefully arranged routes, and arrived at the rendezvous empty; whereupon the wagon was restocked and returned to Berlin by another route. In the case of more distant depots, where this plan was impracticable, the peddler frequently sold his horse and cart at the end of his journey, returning at the end of six or eight months with empty hands and full pockets. Small wonder that even before the Revolution the name of Connecticut became a by-word for small wares and was the best known Colony in the New World!

This unique but prosperous business of course depended entirely upon its elaborate distribution system, for even at its height, about 1830, the manufacturing end was little more than a household industry. In the heyday of Berlin's prosperity nearly every family had its trade, practiced in the home, the shop or the dooryard. The wares themselves were of the simplest structure and single shops with not to exceed ten workmen would supply from twenty to thirty peddlers. With the advent of the railroad, the distribution system collapsed and the peddler gave way to the "drummer."

But the system did not perish until it had laid the foundations for the great metal industries of the manufacturing Connecticut of today. The demand of the

peddlers for buttons encouraged the brass makers of Waterbury, and provided a market for the small brass wares and the cheap brass clocks of New Haven, Waterbury and Bristol. With their sale of tinware and cheap utensils they also encouraged the pewter makers, leading to a demand for a better class of goods and thereby contributing to the establishment of the great Britannia and silver industry in Wallingford and Meriden. Through their agency, New Britain, later set off from Berlin as a town, was stimulated as a tool-making center, and the manufacture of hardware thereby gained a firm foot-hold in Hartford County. In 1819 Seth Peck of Southington patented a tin making machine, which was followed by other tool making machines, and the building of machinery in Hartford and New Haven Counties definitely located the metal industries in Connecticut.

It is logical, then, to proceed first with the story of tools and builders' hardware in and about New Britain —in Hartford, Bristol, Collinsville and Southington.

While, as we are continuously reminded in this volume, the earliest colonists made their tools and hardware at the wayside forge, even before the Revolution a certain degree of specialization was taking place in the villages. That part of Berlin which is now New Britain early turned its attention to the metal trades. Shortly after Pattison had established his tin shop, Thomas Richards and Ladwick Hotchkiss set up forges and anvils. James North, learning the blacksmith trade from Richards, started a smithy of his own. By 1778 the list of products of New Britain blacksmith shops included augurs, brads, bridle bits, nails, chest locks, compasses, cranks, chisels, crow bars, hooks, hinges, knobs,

keys, shaves, spikes, and the various tools and wagon iron needed in agricultural settlements; and it is safe to say that not a few of these products found their way to distant parts in the peddlers' trunks.

In 1798, James North, Joseph Booth and Samuel Shipman each sent a son to Stockbridge, Massachusetts to learn to cast brass, and in 1800 the three young men set up a local foundry for the manufacture of sleigh bells. The business was so successful that each later started his own factory and rapidly added other metal articles to his output. This was the real beginning of the tool industry. In 1812 Alvin North began the manufacture of buckles in a small way on or near the present site of the great North and Judd factory, which grew from this business, and thereby established the manufacture of saddlery hardware in the vicinity. The Embargo and the War of 1812, which cut off foreign importations, gave manufacturers a season of prosperity, which was followed by a period of depression; but in 1820 conditions permitted resumption upon a profitable basis. This stimulated invention, improved the design of machinery and lead to expansion of products; and from that time on the industries began to settle into those channels which they have since followed.

We have thus traced the course of those events which laid the foundations of the tool and hardware trade of Connecticut. It now remains to chronicle the activities of the men who built upon the foundations and developed the great group of industries of which New Britain is the recognized center. In this "Hardware City," as in the "Brass City" of Waterbury, we shall see the growth of three outstanding concerns. In the chapter on "Brass," reference is made to the great

Waterbury triumvirate consisting of the American Brass Company, the Scovill Manufacturing Company, and the Chase Companies. So in New Britain do we find a similar trio, consisting of the American Hardware Corporation, The Stanley Works, and Landers, Frary and Clark Company. In the tool and hardware field, however, we shall find a wider distribution of the business among other large concerns, than exists in the brass line—notable examples of which are Sargent & Company in New Haven and the Yale and Towne Manufacturing Company in Stamford.

Let us first consider New Britain and its vicinity, in which it seems wiser to give a running account of the establishment of the various concerns, with as much observance of chronological order as may be feasible, rather than attempt any exact grouping of the units which have contributed to the formation of the existing concerns.

The oldest firm, North and Judd, was established in 1812, making at first buckles and later other saddlery hardware. Most of the enormous growth of the New Britain factories has taken place since the Eighties. For example, as late as 1872, this concern had but 22 employees, while today it has over a thousand operatives in its factories in New Britain and New Haven. In the mid-century there were changes in ownership, the company becoming North and Judd Manufacturing Company in 1863. The company now holds many valuable patent rights and manufactures the famous "Anchor Brand" of hardware, the trade-mark of which is familiar to workmen everywhere. During recent years, with the trend to the use of automobiles, the manufacturing of saddlery hardware has largely given place to that of

automobile parts. During the World War the company produced great quantities of harness, saddlery, automobile (particularly ambulance) parts; cavalry equipment, knapsack and other infantry hardware equipment; fittings for the famous "Sam Browne" belts and officers' belts, rifle and revolver cartridge belts hardware; helmet and legging fittings; glove buckles; and gas mask parts.

In 1831 was founded the predecessor of the Russell and Erwin Manufacturing Company and in 1849 the P. and F. Corbin Company, which two great companies were to become the American Hardware Corporation. In 1842, Frederick T. Stanley started in a little shop what was to become the Stanley Works. The same year that saw the start of the Stanley Works saw the beginning of Landers, Frary and Clark, and before the Civil War the firm of O. B. North had been added to the list. In these original firms there were changes of personnel and name but the original enterprise can be directly traced. O. B. North & Company, New Haven, saddlery hardware, established in 1855, is connected with the New Britain Norths.

In 1831 Frederick T. Stanley started the first factory for door locks and house trimming, installing the following year what is believed to have been the first steam engine in the State. The business name changed through various stages from Stanley, Woodruff & Company to Stanley, Russell & Company, the New Britain Lock Factory, and finally to Russell & Erwin. The first locks made by them were of a simple slide and bolt type. The first cabinet locks made in the country were manufactured by Stephen Bucknall of Watertown, Connecticut, who in 1840 moved to New Britain and secured a contract to make door locks for North & Stanley

where he also made plate locks. The firm of North & Stanley, the Albany Argillo Works in Albany, New York and one or two small New Britain concerns were purchased by Russell & Erwin in 1850 and the company was organized, after which the business grew rapidly. This was one of the first establishments in the country to make a specialty of builders' hardware, and the assortment has grown until it embraces all of the standard articles in this line required for any building.

In 1875 the company decided to add to their other lines the manufacture of screws, and a large brick building was erected on the north side of Myrtle Street, in which, in 1876, this branch of the business was begun. In 1885, a large manufactory of wood screws in Dayton, Ohio, was purchased. It is still in operation, as a plant of the Corbin Screw Division of the American Hardware Corporation. From the time that Cornelius B. Erwin and Henry E. Russell laid the foundations of the company in 1839, until Mr. Erwin's death in 1885, these two men worked together in harmony, and in cooperation with others, built a great business. Cornelius B. Erwin was president of the company from its organization until his death, and Henry E. Russell was treasurer, succeeding Mr. Erwin as president. The company became a "division" of the American Hardware Corporation on its formation in 1902.

Stephen Bucknall while in the employ of North & Stanley had taught a New Britain lad in the concern, one Philip Corbin, to make plate locks and the same year the boy, still under twenty, secured an independent contract for their manufacture, later taking a partner and

founding the business of P. & F. Corbin. Young Corbin was the son of a farmer, and was born in Willington in 1824. In 1844, he left his father's farm to begin work in the shop of Matteson, Russell & Company, in the direct employ of a lock contractor for that firm. Later in the year he was employed by a lock contractor in the factory of North & Stanley, but he soon secured a contract of his own to make plate locks, a type then in general use, and was employing thirty-five men at the close of his contract. On May 1st, 1849, he embarked in the business of making small brass hardware. He formed a company and acquired a small building on Whiting Street free from emcumbrance, with a grindstone and emery wheel and two lathes, all operated by a horse with a tread mill, and two casting furnaces in a small lean-to. In 1851, the company passed into the sole hands of Philip Corbin and his brother Frank, and the name of the firm became P. & F. Corbin, as at present.

The first product of the firm was brass balls for tipping the horns of oxen. Lifting handles were soon added and other articles followed in rapid succession. At first, the policy of avoiding domestic competition, by making only those goods not before manufactured in this country, was followed, such as flush bolts, lamp hooks, turn buttons, coat and hat hooks, trunk catches, spiral window springs, thread escutcheons, shutter screws, stair rod eyes, which appeared in the first catalogue of the company in 1852. In nearly all of these items the P. & F. Corbin Company were pioneers in America. At one time, stone knobs were exclusively made. Coffin fittings were an early product. They were the second to manufacture wrought brass butts. Gradually, items of builders' hardware were incorpo-

rated in the assortment, and when in 1898 a line of door locks, knobs and escutcheons was produced, the leading trend of production was established, and at the present time the general line of the concern in locks and builders' hardware is the most complete of any in existence.

The little factory on Whiting Street was soon outgrown, and in 1852 additional space was secured by renting a portion of the factory of North & Stanley on the site of the present P. & F. Corbin plant. In 1864, the property was purchased, and from this small beginning has grown the present plant with over twenty acres of floor space, and a large annex in the north end of the city. It has its own source of water supply, operates an efficient fire department, conducts its own packing case, carton and printing plants. The market of the company is the entire world. They are able to boast that their locks and hardware are on "the largest office building ever erected," on the "tallest building in the British Empire," on mammoth structures in all the principal cities, on workmen's cottages, and on "an entire city recently built by a steel corporation." This company, too, became a division of the American Hardware Corporation in 1902.

In 1875, the Russell & Erwin Manufacturing Company decided to manufacture screws. This is a native Connecticut product. In 1809 the early records recite that Ezra L'Hommedieu of Saybrook patented a "double padded screw augur and a process by which from wire a man aided by two boys could make 300 pounds per day of assorted screws, better than imported." Before the days of machinery, screws were a difficult product to manufacture, because, being made by hand, they were usually inaccurate; or, if accurate, too expensive

for general use. At first, the line consisted of wood screws of which a full assortment was made. The business grew rapidly, and the facilities for manufacture were increased to meet the great demand. In 1885, a large factory in Dayton, Ohio, was purchased, which gave the concern a greater output and provided a central distributing point. At the time of the formation of the American Hardware Corporation, the screw business of the Russell & Erwin Manufacturing Company was an important factor in its activities.

In 1876, P. & F. Corbin also began the manufacture of wood screws to be shipped with its locks and hardware as a part of the equipment for installation, purchasing for the purpose sixteen machines used by Cotter & Company, another Connecticut concern. Charles Glover, who at that time was connected with the National Screw Company of Hartford was engaged to produce this line. He invented machines which were greatly superior to any then in use, of which the company built a considerable number. This, of course, gave them an excess of product over that required for the original purpose, and led the company to add screws to their line for merchandising purposes. The plant was thereupon enlarged and a large business built up in a general assortment of screws.

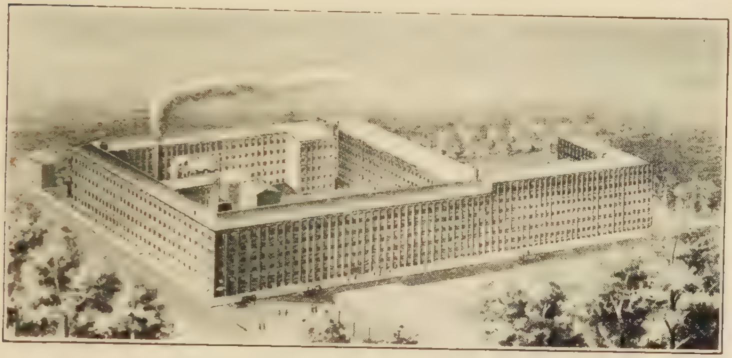
When the American Hardware Corporation took over the Russell & Erwin Manufacturing Company and P. & F. Corbin, it was deemed advisable to consolidate the two screw departments, and the Corbin Screw Corporation was formed, with Charles Glover as president. It became another of the "divisions" of the American Hardware Corporation. Under the new organization

the pace of development was accelerated, and since that time new buildings and new machinery, with greatly increased output, have aided materially in the growth and prosperity of this division. The product includes all types of screws and screw machine products, coaster hubs and brakes for bicycles and motor cycles, speedometers for motor cycles and automobiles, and special parts for other products. The goods are sold in all markets.

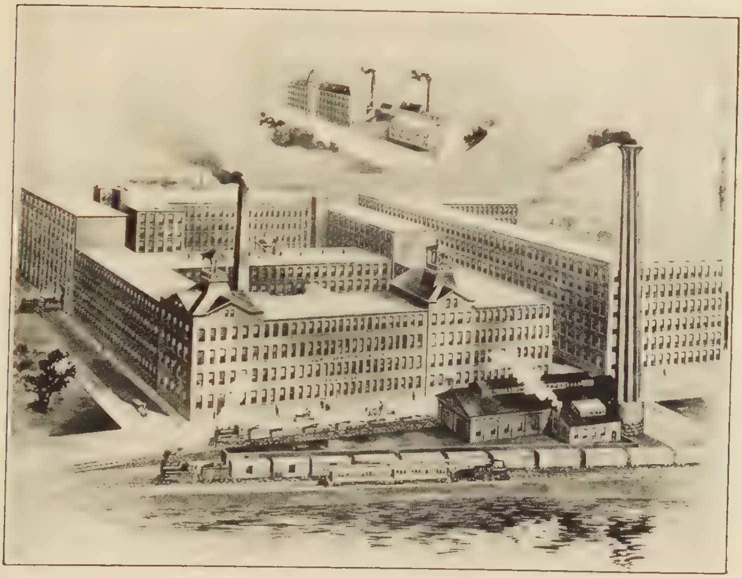
About 1880, P. & F. Corbin embarked in the manufacture of cabinet locks. It soon became evident that the problems connected with their sale and manufacture were such that they could be handled best by an organization specially formed for the purpose, and in 1882 Philip Corbin was instrumental in the incorporation of the Corbin Cabinet Lock Company, with a capital stock of $100,000. As first formed, the officers and directors were the same as those of P. & F. Corbin, and operations were conducted in the P. & F. Corbin plant. The growing needs of the new company made larger space imperative, and the removal to another city was contemplated; but, to keep the business in New Britain, P. & F. Corbin erected a brick factory building at the corner of Park and Orchard Streets for its occupancy. On November 1, 1883 the building was completed. In 1885, a larger addition was made; another, doubling the capacity was erected in 1891, and other additions, all following the same general plan, have given the concern the space required for the largest business of the kind in the country.

The first manager of the business was George W. Corbin, who left P. & F. Corbin to take charge of the business of the new company. He was succeeded by Carlisle

FACTORIES OF THE AMERICAN HARDWARE CORPORATION OF NEW BRITAIN, CONNECTICUT, U. S. A.

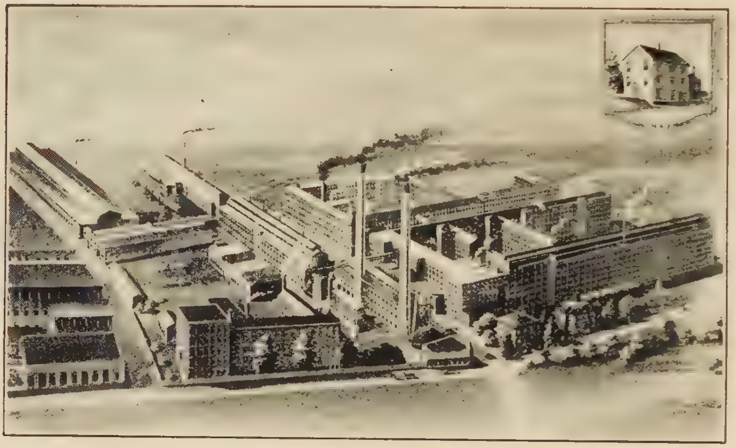


Corbin Cabinet Lock Co., Division
New Britain, Conn.

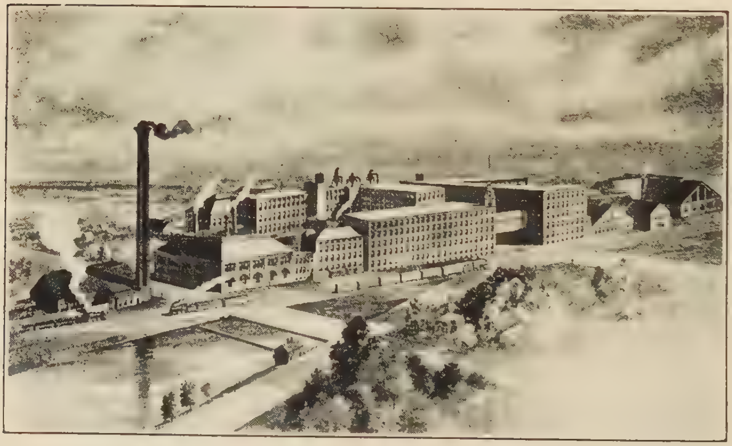


Corbin Screw Corporation Division
New Britain, Conn., and Dayton, Ohio

FACTORIES OF THE AMERICAN HARDWARE CORPORATION OF NEW BRITAIN, CONNECTICUT, U. S. A.



P. & F. Corbin Division,
New Britain, Conn.



Russell & Erwin Manufacturing Division,
New Britain, Conn.

H. Baldwin, who was president of the company at the time of its becoming a division of the American Hardware Corporation, in 1905. In addition to the cabinet locks which formed the original product, the Corbin Cabinet Lock Company have added kindred lines, each of which they have developed to full assortment and in which they occupy a leading position. Their padlocks cover all types in general use as well as special kinds designed for export consumption. They also make keys for locks of all kinds, a full complement of trunk and suit-case locks and fittings, cupboard and wardrobe locks and a general line of hardware fittings for chests, cases and miscellaneous use. They also manufacture metal parts to be incorporated in goods of other manufacturers.

We have thus gathered up the threads which united in the knot tied by the organization of the American Hardware Corporation in 1902, consisting at first of Russell & Erwin and P. & F. Corbin, to which was added in 1905 the Corbin Cabinet Lock Company. The company now operates, as has been seen, through four "divisions"—known as the Russell & Erwin Division, the P. & F. Corbin Division, the Corbin Cabinet Lock Division, and the Corbin Screw Division. As first formed, the American Hardware Corporation was a holding company, each division having its own officials and operating independently. In 1911 it became an operating company, with one governing set of officers, each division being in charge of a general manager. In its trade relations and inner organization each division is independent of the others, its activities being controlled by its general manager, under the direction of the general

officials. It has about 8,000 employees, a capitalization of $12,500,000 with a surplus of more than $4,000,000.

From the time when the United States entered the World War, the plants of the American Hardware Corporation were at the service of the Government, and, at its close, fully seventy-five per cent of the product was of material used in its prosecution. A large portion of the articles furnished consisted of the locks and hardware regularly made, but as the war progressed an increasingly large proportion consisted of munitions. The principal items supplied consisted of locks and hardware for cantonments and new Government War buildings, locks and fittings for field equipment, arsenals and battleships, marine hardware for vessels of all kinds, hand grenades, mark VI trench mortar fuses, parts of gas masks, magazines for Browning rifles, belt buckles, tent slips, fuse adapters, screws, bolts, turnbuckles and miscellaneous screw machine products, for aeroplane parts, gun sights, etc.

In some instances, the goods were made on subcontracts in conjunction with other manufacturers, and in others the contracts were made direct with the Government. Special departments were formed and the manufacturing organization of the divisions changed to meet the demands for quick delivery. The product for the usual trade channels was reduced to the lowest point possible in order to devote the material and capacity to the articles required for the conduct of the war.

Two other great companies, engaged in the tool and hardware trade and bearing the same generic name, have grown up side by side in New Britain and were recently merged into one concern. These are The Stanley Works and The Stanley Rule & Level Company,

and are treated at some length because of the fidelity with which they typify Connecticut industrial methods.

Frederick T. Stanley was of pioneer ancestry, his forebears having been among the first settlers of Farmington, and the pioneer spirit was strong in him. He had helped in 1840 to establish what is now the Russell & Erwin Manufacturing Company in New Britain; and two years later, with little capital except his courage and faith, he moved over to Lake Street near Washington Street in New Britain and set up a small bolt shop of his own.

He was production manager, sales manager, and general manager all in one. He fashioned bolts with his own hands; when he had collected a fair assortment, he would set out behind his old mare, into the country districts, and having sold his bolts to the farmers, proceed to attach them to barn doors and farm houses with his own screw-driver.

It was an important day in the life of Stanley and the village of New Britain, when ten years after the opening of the little Lake Street shop, several neighbors joined him in his enterprise. They pooled their savings to provide a capital of $30,000 and incorporated under the name of The Stanley Works. Butts and hinges were added to the original Stanley bolts, and the working force was increased to 25 men. At about that time there came to work a lad of 19, whose name is linked closely with the development of The Stanley Works for the succeeding half century—William H. Hart. If Stanley was the founder, Hart was the organizer and builder. In every department of the striking growth of this institution, be it production, distribution or financing, his sure and steady hand is to be seen. The

period of his service was from 1852 to 1919, and the great plant stands as his memorial.

Somewhere about 1871 a great forward step was taken in the making of better hardware. The Stanley Works developed the process of Cold Rolling steel, and were the first in the hardware world, and perhaps in the entire metal industry, to manufacture products by this process. When we realize that today thousands of useful articles are made by this method we recognize what a step in advance this marked. For a long time competitors and users knew that somehow, somewhere, in the process, an element of superiority had been introduced; but they did not know just how it had been accomplished. When we add to the long list of products for which The Stanley Works produce cold rolled steel, making their own steel in their own open hearth furnace and converting it through their own billet, hot and cold rolling mills, we discover that the influence of the company penetrates into almost every single department of daily life. The alarm clock which wakes you tomorrow morning, the lock on your door, the pedals on your children's bicycle, the bell on your telephone—these and a hundred other articles are made from Stanley steel.

In the Eighties and Nineties a new generation came into the company, with new vision in both producing and marketing the product. Scientific research paved the way for the many practical improvements in processes. Experimental, model, design and construction and laboratory units contributed to all departments.

During this same period far-reaching strides were taken in marketing. The trend of commerce pointed westward and those in charge of sales were quick to

seize the opportunity. At this same time they also saw the advantages which were bound to come to American industries through export developments and connections. Partly through exporters and partly through their own direct representatives, who made personal investigation and sales trips around the world, the company laid the foundation of an export business which today, in proportion to its line, is probably second to none in the United States.

There have also been co-ordinate developments. In 1910 a plant was added for the manufacturing of box strapping. Today one may stand on the platform of his local freight depot, or on the docks where great steamers load, and see boxes and crates marked for South America, India, Australia, and the whole world —all strapped for safe shipment with Stanley Box Strapping. It has become a prosperous business in itself of world-wide scope.

In the same way the so-called Special Productions Department grew up from small beginnings. It began with the manufacture of special hinges. This department has grown into a major business in itself. Today it makes parts for automobiles, for vacuum cleaners, kitchen cabinets, office appliances, alarm clocks and a multitude of other articles.

The Stanley Works has had three dominant policies throughout. The first has been to provide new capital for its increasing growth. This has been done by leaving a liberal amount of the earnings in the business and by asking the stockholders in addition to provide more capital. From a beginning of $30,000, the market value of the shares today is approximately $26,000,000.

The second has been the control of its materials and

the elimination of waste. With their control of the continuous processes in their own open hearth furnace, their billet mills, their hoop and band mills and their cold-rolling mills, the steel business was developed in the execution of this part of the program. So also they purchased control of the Connecticut Metal and Chemical Company, now known as The Stanley Chemical Company, which was designed originally to reclaim values from metal waste, but which has also grown to large proportions as a maker of brass and bronze castings, paint, dyes and chemicals. In the economical use of a by-product they developed a plant where sugar copperas is made, which is sold to manufacturers of red paint.

The Farmington River Power Company was purchased as yet another step in this same plan and from this source The Stanley Works now receives a large share of its electric power. With corresponding foresight they have gone forty miles to the Housatonic River and have bought a large acreage on both sides of the river where they control natural resources for a potential power plant. A large tract of land, served by three railroads and lying along the Mahoning River between the cities of Niles and Youngstown, Ohio was purchased. Here were erected complete fireproof mills of great capacity for the manufacture of its heaviest products. In 1898 the Bridgewater Iron Company, Bridgewater, Massachusetts, was purchased and the plant converted into a hot rolling mill, which has been developed to meet the needs of the steel business and is now a branch plant of the steel department. The Stanley Works developed at the Bridgewater plant a foundry and construction department capable of building all its own rolls and heavy

The Stanley Rule and Level Plant of the Stanley Works, New Britain, Conn.

machinery. A Canadian factory at Hamilton, Ontario, joined the forces in 1914; and now, after several additions and consolidations, it is known as The Stanley Works of Canada, and is the largest producer of hardware of the Stanley type in the Dominion. In 1916 they began to manufacture cold rolled steel for distribution throughout Canada under the name of the Stanley Steel Company of Hamilton, Ontario. Finally the Crescent Works in Kobe, Japan, was added, where a small number of native workmen under American management are producing a few lines entirely for the Oriental markets; this move was made to supplement the work which had been done in introducing the products throughout the Orient.

The third policy to which The Stanley Works has adhered throughout has to do with the spirit of co-operation between the man at the desk and the man at the bench or machine. There has been a studious attempt to avoid any sharp line between "capital" and "labor" in the plant. There is no "absentee" ownership. No individual owns as much as a tenth of the stock and many of the stockholders are also wage earners. Every worker, from apprentice to manager, is encouraged to share in the ownership of the business; and each year a block of stock is offered to the employees on easy payments. There is not a department of the company without stockholding employees. The officers, superintendents, managers and foremen of today were the beginners of yesterday.

The recent amalgamation, by purchase, of The Stanley Rule & Level Company with The Stanley Works was a logical step. The histories of the two concerns

interlock at many points. Just before the Civil War, The Stanley Works opened a store and sales office in New York City. There it sold non-competitive products made by other New Britain and Connecticut manufacturers. Among them were the rules and levels, and try-squares and bevels of The Stanley Rule & Level Company.

This concern traces its origin back to 1850 when Augustus Stanley, Gad Stanley and T. A. Conklin of New Britain, formed the firm of A. Stanley & Company to manufacture boxwood and ivory rules. All went well for the new enterprise and in eight years they merged with four other young companies still making boxwood and ivory rules, but adding to their products, plumbs, levels and even tool handles and mallets.

The handles made by the young company proved to be immediately popular. All the standing hickory timber within a radius of fifty miles of New Britain was purchased and two pairs of horses and a yoke of oxen were used to supplement the meagre railroad transportation facilities in bringing the timber to the factory.

The rule manufacturing end of the business increased greatly when in 1862 the rule factory of E. A. Stearns & Company at Brattleboro, Vermont, was purchased from C. L. Mead. Five years later the equipment was moved to New Britain and Mead came into the Stanley Rule & Level Company as treasurer, bringing with him many skilled workmen.

The diversity of the company's products in those early days is an interesting feature of its story. Besides the rules and levels, squares and bevels, and hickory handles and mallets, the company manufactured caster wheels, furniture knobs and drop handles, ear rings, breast pins,

and sleeve buttons of boxwood and vegetable ivory; wooden checkers, chess men, match safes and other articles. Many of our grandmothers darned their stockings on Stanley darners; and our fathers played with toy wooden pistols made by The Stanley Company. The skates used on the first roller skating rink in this country were Stanley made. This rink, one of the boasts of New Britain, was in the second floor of old "First Church."

Experience, however, demonstrated the inadvisability of strict specialty manufacturing, and a definite policy, concentrating the company's efforts on carpenters' and mechanics' tools, was adopted. In 1869, to the original tool lines manufactured, was added the famous "Bailey" plane and spoke shave, the patents for which were purchased from Leonard Bailey of Boston. This addition to the Stanley tools marked a turning point in the company's history and the popularity of the new type of iron plane proved so great that today the old-fashioned wooden plane has virtually been driven out of business in this country and each year is losing place in Europe and other parts of the world.

Mitre boxes, screw drivers, iron and wood bevels, braces, hammers and steel squares gradually were added to the Stanley tool lines as the latter half of the nineteenth century advanced, and today the company produces probably the most complete line of woodworking tools in the world. The company buys more rosewood than all the other concerns in the country and with it imports vast quantities of boxwood and mahogany.

In 1904 the company bought out the George E. Wood Company of Plantsville, Conn., makers of the famous

"Hurwood" screwdrivers. In more recent years, the Plantsville branch began the manufacture of woodworking chisels.

The present Bridgeport branch of the company was acquired in 1909. It formerly was the John S. Fray Company. At this branch are made Stanley bit braces, bit extensions, tool handles and several other articles. Between the New Britain plant and the Fray plant, The Stanley Company has the largest output of bit braces in the country.

In 1913 The Stanley Company purchased the business of the Atha Tool Company, of Newark, N. J., and the Newark branch now is the largest of the Stanley subsidiary plants. Here is made a complete line of handled hammers, sledges, wedges and anvil tools. The hickory handles of Stanley hammers are made at the Newark factory out of the billets shipped from the 15,000 acre hardwood tracts which the company owns in Tennessee and Alabama.

The original "Atha" trade-mark, consisting of a horseshoe design has been retained by The Stanley Company and is stamped on all the hammers, sledges and iron and steel working tools made at the Newark plant.

To maintain the position of Stanley tools in Canada, The Stanley Rule & Level Company purchased the Roxton Tool and Mill Company, Ltd., at Roxton Pond, Quebec. The Canadian branch has been continued under the name of The Stanley Tool Company, Ltd., and to the planes originally made by it have been added other tools, so that now the Roxton factory manufactures 80% of the full line of Stanley tools sold in Canada.

In addition to these branches The Eagle Square Manufacturing Company of South Shaftsbury, Vt., was pur-

chased and is operated as a branch plant. This company was founded in 1817 and is now the largest manufacturer of carpenters' steel squares in the country. There is also a wood working plant to utilize local hardwoods, which are made into handles, mallets and zig-zag rules.

The historian of the Stanley Works adds this significant comment:

> "Much of the incident and anecdote, the high lights of business romance, must necessarily be neglected. But in each case the impressive fact is the same—the stability of the growth; the fact that no step has ever been taken which had to be retraced, and that each new unit acquired and consolidated with either of the two companies, has been ushered into an immediately larger success.
>
> "New England enterprises are not spectacular. Other companies in other sections leap more easily into the high lights of public consciousness. But what New England builds is built to last."

We now come to the third of the great New Britain concerns, Landers, Frary & Clark, which has been the largest producer of table cutlery in the world, and the developer and manufacturer of the extensive line of electrical household appliances bearing the trade-mark "Universal."

In 1842 George M. Landers formed a partnership with Josiah Dewey for the manufacture of furniture casters, cupboard catches and other small articles. This partnership was dissolved in 1847 and Landers continued in the business alone. He started a foundry and added to his original product the manufacture of coat and hat hooks, brass hooks and eyes and other small articles, the company being incorporated in 1853, as Landers & Smith Manufacturing Company. In 1862

the business of Frary, Carey & Company of Meriden was purchased and the company was again reorganized under the name of Landers, Frary & Clark Company.

The company soon centered its attention upon table cutlery which lead to an interest in other household articles. It was quick to sense the possibilities of electricity in its application to home management and economics and has brought out and popularized every variety of device, from small toasters, grills, waffle irons, and percolators to great electric stoves. The smaller pieces are made of nickel or aluminum, the nearby production of nickel, nickel silver, and German silver in Meriden and Wallingford being of marked value to the industry, as was the more recent development of aluminum on a commercial scale. The company employs normally about 4,000 persons, and its products are sent to all parts of the world.

In connection with the development of table cutlery, of which Connecticut is the center and Landers, Frary & Clark the leader, the following account contributed by Homer A. Curtiss of Meriden, sometimes called "the Dean of the Cutlery Industry," is of historical value:

Up to 1832 cutlery used in this country was imported mostly from England and was of a crude design and finish. In 1832, D. N. Ropes began the manufacture of ivory handle cutlery in Sacarappa, Maine. He imported the ivory in tusks, but there was a large waste in cutting the ivory as the smaller pieces could not be used. Mr. Julian Pratt of Meriden at the same time was making ivory combs. These two men found that they could effect a great saving by combining in the cutting of ivory the pieces to be used by both parties. This resulted in Ropes moving his business to Meriden in 1845. A company was formed, named Pratt, Ropes, Webb & Company, this being the first cutlery manufactory in Connecticut, and indeed, the United States.

In 1855 the company was incorporated as the Meriden Cutlery

Company and this factory is still running today. The company branched out into different lines of table cutlery, and by adopting labor-saving machinery and standardizing patterns and parts they were able to produce a much better quality and finish than could be obtained abroad. Where cutlery had always been made by hand, mostly by workmen who did all the work themselves, this policy made it possible for cheaper lines of wooden-handle cutlery to be produced in quantities at prices which had been impossible on imported goods. Ivory-handle cutlery was not satisfactory in use as the ivory was apt to crack, and when the process of vulcanizing rubber was discovered the Meriden company adopted hard rubber for their knife handles. This took a high finish and was indestructible, and soon became very popular for the better quality article.

The next important invention which affected cutlery was the material known as celluloid. As this was a crude imitation of ivory that would not crack, it rapidly came into common use. The Meriden company was the exclusive manufacturer of these two lines for a long time. About 1865 the company began the manufacture of solid silver handle cutlery, handle and blade being all one piece, and silver-plating it by an electric process. This is the cutlery used largely in restaurants today. With the improved designs and quality of forks and spoons made by silversmiths, there came a demand for knife handles of similar pattern which resulted in the manufacture of hollow silver-handle cutlery, the blades being made by cutlery manufacturers and soldered into these handles.

Nothing had shown greater progress by American manufacturers than the lines of carving knives and forks for beef, game and bird carving. Stag-horn handles have been largely used for this line, but rubber, celluloid and silver handles, too, have always been used.

In the process of manufacturing cutlery many operations are necessary, the most important being forging, tempering and grinding. For many years grinding was done by hand and could only be done by experienced men who had become skilled artizans in the trade. The process was slow and the output limited. By the invention of the automatic grinding machines, one man could do the work of at least three and this handicap on production was removed. Steel manufacturers have also made great improvements in material for knives. The greatest improvement, and one which has resulted in radical changes in the output, is the intro-

duction since the war of stainless steel, which is now available for commercial use. The steel which does not stain or rust in use overcomes a serious objection to ordinary crucible steel when not silver plated, and is rapidly coming into general use.

In the manufacture of cutlery pearl from the Indian Ocean, stag from the Steppes of Russia, ebony from Madagascar, rubber from South America, cocobola from Panama, bone from Chicago, celluloid a home product, beech and walnut from our forests, and steel from the mills of Pittsburg, are all brought together and transfused into the finest grades of table cutlery.

Landers, Frary & Clark and the American Cutlery Company are the only concerns in Connecticut which have made full lines of tableware. These two companies are now consolidated. Other companies have made partial lines and these products have been exported to all parts of the world. Landers, Frary & Clark now also make a full line of pocket cutlery and shears. The Naugatuck Valley towns, such as Thomaston, Winsted, Watertown and Naugatuck have had many of these factories.

In addition to the three great institutions whose careers have been sketched at considerable length, there are a large number of secondary concerns in New Britain and nearby cities and towns engaged in turning out similar commodities, whose histories are illuminating and whose accomplishments are noteworthy. Of these, the North & Judd Company has been treated in its proper chronological place.

A company that has been more recently established, but discloses an interesting history, is the Traut & Hine Manufacturing Company of New Britain, makers of miscellaneous small metal objects such as safety razors, metal stationery supplies, upholstery nails and metal trimmings for suspenders and belts. The company was organized in 1887 with a capital stock of $16,000; it is now capitalized for $1,000,000, and employs between three and four hundred employees. During the war 75% of the product of the plant was devoted to govern-

ment needs, making metal trimmings for cartridge belts and gun slings as well as cartridge clips. A striking fact in connection with this company, dated in 1902, is that the United States then led the world in the number of patents taken out, Connecticut led the United States, Traut & Hine headed the Connecticut list and the founder, Justus A. Traut, held the greatest number of patents and had never taken out an unsuccessful one. This concern has recently been purchased by the North & Judd Manufacturing Company.

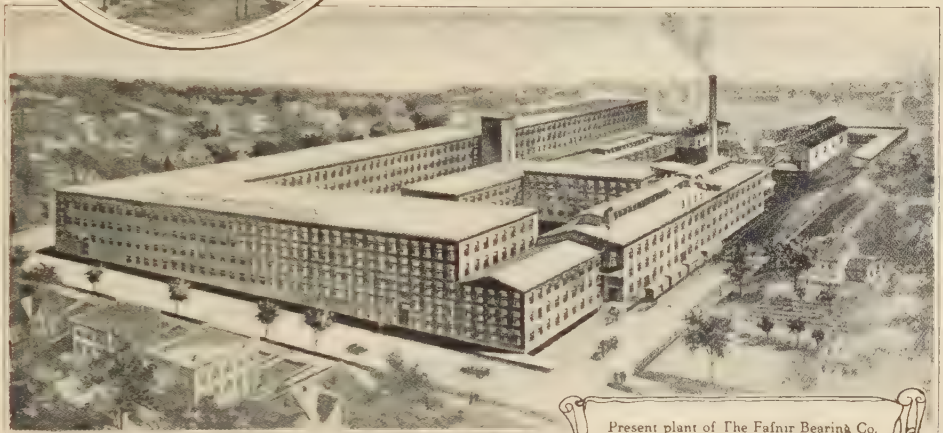
The name Hart, mentioned in connection with the Stanley Works, appears in two of the newer New Britain companies, Hart & Cooley Company and Hart & Hutchinson Company. The former of these was organized in 1901 by Howard S. and Geo. P. Hart, (sons of William H. Hart of Stanley Works fame) Norman P. Cooley and L. H. Pease and engaged in the manufacture of warm air registers to be made by wrought steel. Prior to this undertaking, registers had been made entirely of cast iron which was heavy and brittle and consequently not entirely satisfactory. The idea of making registers of wrought steel occurred to Howard S. Hart, while he was in the cold rolled steel business and the early patents stood in his name. L. H. Pease had been connected with the Stanley Works in their manufacture of warm air registers. Later the company became interested in the development of wrought steel lockers, the need for which was created by the great office buildings and institutions of the twentieth century. Steel lockers were first made in Camden, New Jersey, and a Rhode Island company claims to have first made them for school use. Their first use in Connecticut was their

installation in the New Britain Y. M. C. A., and in the nineteen years since that time they have become commonplace in public buildings, clubs, office and factory buildings.

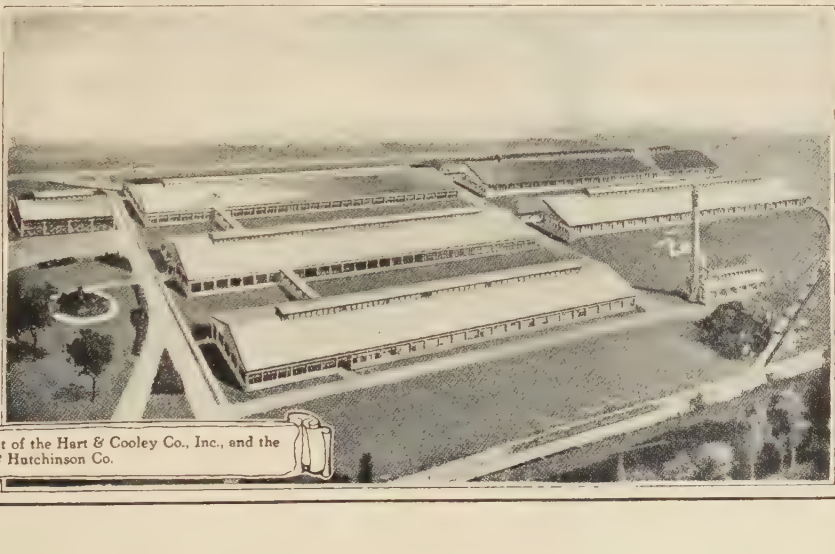
This part of the business was purchased by the Hart & Hutchinson Company in 1912, who have since carried it on and enlarged it to include steel cabinets and steel partitions. The original company, Hart & Cooley, then became interested in the manufacture of ball bearings and this undertaking proved so successful and grew to such proportions that a third company was formed, the Fafnir Bearing Company being organized for the purpose. The Hart & Cooley Company is a large stockholder in both the companies which have grown from it. The parent company supplied registers for a large proportion of the cantonments and housing operations necessitated by the war. The Hart & Hutchinson Company furnished almost the entire outfit of lockers for the Emergency Fleet and also supplied the Navy Department with a big proportion of the lockers purchased for the Navy, munition factories and other departments of the Government. The company does a business of approximately one-half million dollars annually, maintains branch offices in the four principal cities of the United States and ships to North and South America, Panama, India and Australia.

The Fafnir Bearing Company, makers of the ball bearing developed by Hart & Cooley under the direction of Howard S. Hart, was organized in 1911. This company is said to have been the first to make successful ball bearings in this country of a type comparable to the English product. Until 1914, 80 per cent of the ball

Original factory of the Hart & Cooley Co., 1901



Present plant of The Fafnir Bearing Co.



Plant of the Hart & Cooley Co., Inc., and the Hart & Hutchinson Co.

bearings used in the country were imported—mostly from Germany. European methods were studied in Germany and England and until the war all steel used in the product was from the former country and all balls were imported from England. The company has developed an American source of supply for a suitable alloy steel; has designed machines, tools and gauges necessary for quantity production; and the bearings are now an all-American product and can be marketed at a lower price than before the war when made of imported materials. With the war the emergency was acute. Bearings were essential for the usual purposes of automobiles, machine tools, electrical motors, etc. and for specific war use in trucks, tractors, tanks, aeroplanes, gyroscopic compasses, guns, mountings and innumerable important purposes, not only in the United States but among the allied nations which had also depended largely on Germany. The Fafnir Bearing Company was, as a natural result, pushed to limit capacity. A large part of its output during the period was devoted to the manufacture of ball bearings for French and English aeroplanes. The plant has grown from a little shop employing seven men in 1912 to a concern with a capital of $1,500,000, and employing over 1,000 hands.

Two other new concerns which have been markedly successful are G. E. Prentice Manufacturing Company (1912) manufacturers of small metal trimmings for belts, suspenders, etc., and the Beaton & Caldwell Company. The latter company manufactures steam specialties used in installing heating appliances for all types of buildings. The business was founded as Beaton & Bradley in 1894 by A. J. Beaton and Alfred E. Bradley in Southington and originally made only floor plates or

escutcheons for floors and ceilings. As the company grew, many varieties of steam specialties and metal stampings were added to the output.

Another large New Britain concern, the New Britain Machine Company, successors to The J. T. Case Engine Company, was organized in 1895. It acquired, immediately on its organization, the patents on a chain saw mortising machine owned by the Dubuque Machine Specialty Company. The company proceeded to develop the mortiser and did a jobbing machine business for several years. Early in 1911 the business of the George G. Prentice Company, Incorporated, of New Haven, was acquired. By this purchase a line of semi-automatic multiple spindle machines was added to the New Britain Machine Company line, making it possible for the concern to enter the metal working field with an advanced type of a high production automatic labor saving machine. The design and adaptability of the machine was improved through R. S. Brown, chief engineer and secretary of the company, and several patented improvements were added, so that the company was able very materially to increase its business through its sales.

In 1914 the multiple spindle automatic screw machine business of the Universal Machine Screw Company of Hartford, was acquired, still further adding to the company's activities in the metal working trades. Christopher M. Spencer, one of the pioneers in the design of automatic screw machinery, became connected with the company at the same time and through his efforts and those of R. S. Brown, this machine was improved in design and is recognized as exemplifying

Office and Factory of the Beaton & Cadwell Mfg. Company, New Britain, Conn.

the highest development of design in automatic production machinery.

During the World War the company was called upon by the United States Government to manufacture 75 millimeter and 3-in. anti-aircraft gun carriages, and to meet the war time requirements the capital stock of the company was increased and extensive additions were made to the company's buildings and machine equipment. When the Armistice was signed the company had completed and delivered its contract for 75 millimeter gun carriages and was in intensive production of the 3-in. carriages. The company also manufactured several thousand machine gun tripods, several different designs of artillery sights and other ordinance items for the War Department, as well as furnishing a considerable amount of special machinery for ammunition factories in this country, France and England. On the signing of the Armistice the company found itself working practically 100% on war work.

Early in 1919 a Screw Products Department was added to the business. At the present time The New Britain Machine Company is manufacturing a complete line of multiple spindle automatic screw machines, multiple spindle automatic chucking machines of the tool rotating type, a comparatively new line of New Britain "New-Matic" chucking machines, four and six spindles, work rotating type, screw products of every variety, socket wrenches, mortisers and mortiser supplies, and a complete line of pressed steel shop furniture.

In Torrington, the Union Hardware Company, established in 1854, makes a line of builders' tools and small hardware similar to that turned out in the New Britain

plants. Its original product was ice skates, to which roller skates were soon added. A catalogue bearing the date 1876 shows a "parlor" or "floor skate," with four wheels all in a row. The company has since added tackle-blocks and steel fishing rods, and, with the purchase in 1922 of a firm in South Coventry, now manufactures silk fishing lines. Other sporting goods have been added to its output. The company has over 1000 employees and a capital stock of $1,800,000.

In Bristol are other hardware and tool manufacturers, prominent among whom are the Wallace Barnes Company, makers of springs, screw machine products, wire and steel. Manufacturing along these lines in Bristol was started in the Fifties with the making of steel hoops for hoop skirts and springs for clocks. While the hoop skirt remained in vogue, several Bristol factories were busy night and day turning out the steel hoops. When it went out of fashion, they turned their attention to clock springs, clocks being manufactured in great quantity in and near Bristol. In 1857 Wallace Barnes, together with E. L. Dunbar, who had been previously making clock springs on a small scale, formed a partnership under the name of Dunbar & Barnes, Barnes later buying his partner's interest and forming the Wallace Barnes Company, which has remained in the family to the present time, being now managed by the grandsons of the founder. With the development of machinery, springs, like other similar products, were refined and perfected and varying types were devised for specified purposes. Methods of treating steel for spring work have been perfected. The Wallace Barnes Company has its own cold-rolling mill where the steel is specially prepared. During the World


MAIN PLANT
SPRINGS WIRE & STEEL
ESTABLISHED
"BARNES-MADE" PRODUCTS
1857
SCREW MACHINE PRODUCTS
RIVERSIDE AVENUE PLANT
Factories of
The WALLACE BARNES COMPANY
Bristol, Conn. U.S.A.
COLD ROLLING DEPARTMENT
DUNBAR BROTHERS PLANT

WALLACE BARNES
FOUNDER

CARLYLE F. BARNES
PRESIDENT

Three Generations of Spring Makers

The WALLACE BARNES Co.
BRISTOL, CONNECTICUT

FULLER F. BARNES
GENERAL MANAGER AND TREASURER

HARRY C. BARNES
SECRETARY

War the company undertook little manufacturing other than war contracts, making springs in numberless varieties for munitions, particularly gun springs. Its average number of employees is 800.

The Sessions Foundry Company in Bristol are makers of large and small iron castings. The concern has grown from a small plant with less than 20 workmen and netting about two tons of iron every second day to an establishment of 600 employees where four cupolas or melting furnaces are run simultaneously. It is the only plant in New England in this line of business where more than two cupolas may be seen melting iron simultaneously. The small castings made by this company, consisting of parts for hardware, carpenters' tools, lawn mowers, lamps, and clocks, classify this concern among the Hartford County tool-makers. The larger castings, however, would place it in the machinery group, being used for machinery, machine tools, electrical machinery, locomotives, passenger and freight cars, steam boilers works, sugar refining works and heating apparatus. Many large castings are made to order.

The Horton Manufacturing Company, Bristol, makers of hardware, have specialized in sporting goods, notably the steel fishing rod and steel golf shafts which are its exclusive development. In 1887 Everett Horton, a mechanic and inventor of Bristol, showed a friend a telescopic fishing rod made of steel, with a contrivance to run the fishing line from the reel through the center of the hollow steel tube out through the tip, thus doing away with the commonly used "guides" on the outside of fishing rods. The friend saw merit in this invention and associated with himself other parties to produce the article for the market. The company started the

manufacture of this rod in an old frame factory building on North Main Street in Bristol, known as the "Way Shop." The building was at the location of the present factory, and remained as part of the plant until 1908 or 1909. The early days of the Company were beset with difficulties. No one had ever heard of a steel fishing rod, and it was at the first condemned as not being of the approved and accepted type of fishing accoutriment. In addition to these difficulties, the company soon found that a telescopic rod alone would not fulfill the requirements of the trade, and it began to manufacture jointed rods with outside guides, and these now form a large part of its output.

This company was the pioneer in the steel fishing rod industry, and until about ten years ago nothing was added to its line in the way of sporting equipment. At this time the company bought out a concern in Louisville, Kentucky, engaged in making high-grade bait-casting reels, as delicate in mechanism as a fine watch, and standing alone in the trade as a fine piece of fishing equipment for the expert. About the year 1921 the company perfected, under patents of Arthur F. Knight, of Schenectady, N. Y. with the aid and assistance of the General Electric Company, a golf club shaft of steel known as the "Bristol" Steel Golf Shaft. This shaft is now accepted by golfers and enjoys wide and extensive use, having in many places displaced the traditional hickory shaft. During the World War the company made tens of thousands of jointed steel flag-staffs for signal work, and had just completed a large contract of this kind when the Armistice was signed in 1918.

Another branch of hardware manufacture to be developed chiefly within the State is that of bolts and

The Sessions Foundry Co., Bristol, Conn., 1880

The Sessions Foundry Co., Bristol, Conn., 1923

nuts. A full account of this may be found in a "History of the Bolt and Nut Industry of America," by W. R. Wilbur of Cleveland. The first bolts to be made commercially, as distinguished from those made for special purposes at the nearest blacksmiths' forge, were produced in the little wooden factory of Rugg & Barnes in Marion (Southington) in 1840. Micah Rugg was a country blacksmith, who in his spare time made tools to order, especially scythes for which he was noted. He made bolts for his own repair work and sometimes sold an extra supply for 16 cents apiece. He finally invented two machines for making carriage bolts, one of which was the forerunner of the modern scheme of bolt turning. Eventually the manufacture of bolts and nuts engaged his entire time. With the aid of six operators, his machines turned out 500 bolts daily. His partner, Martin Barnes, invented and constructed the first machine for cutting threads on bolts and made other improvements, for which, on account of a trivial matter of red tape, he never received a patent or monetary record. The two partners by these processes turned out an excellent type of bolt, for which they expected to find a market in the great carriage factories of the period in nearby New Haven. But, because of its cheapness and perfection of shape, the carriage trade refused to try the new product, suspecting it of being of cast iron or some other inferior material. It is recorded that, after examining the bolts—generally with their teeth—the carriage makers returned them to the eager Barnes, with a Yankee grin and incredulous shrug. The depression of 1847 caused the struggling little firm, with its too-good product, to fail disastrously, leaving no assets

and heavy debts. Barnes lived to see great fortunes made by his neighbors from his own invention.

Southington, Plantsville and Unionville continue to be the bolt and nut center of the State. A. P. Plant & Company, founders of Plantsville, controlled the bolt and nut business for nearly twenty-five years, using the Rugg & Barnes principle, there being only two other manufacturers of any importance in the country—Coleman Brothers of Philadelphia and Russell, Burdsall & Ward of Portchester, just over the New York State line. Machinery was improved and, with the thriving carriage industry close at hand in New Haven, the company developed a large business. Other companies were formed from time to time in the vicinity, which largely passed into the hands of the Clark Brothers Bolt Company, the Aetna Nut Company and the Bourne-Fuller Company (formerly Upson Nut Company) of Unionville, Conn.

The Aetna Nut Company was founded in 1869 by R. A. Neal, assisted by Peck, Stowe & Wilcox of Southington, who for many years used most of the output. The Clark Brothers Bolt Company of Milldale was founded by William J. Clark and his two brothers, in 1851. This company now turns out about 70,000,000 bolts per year, and it is in this plant that the modern commercial process of cold beading for carriages, machines and plows originated. In New Britain, and especially in towns near New Haven, this manufacturing was taken up to supply the New Haven carriage trade. The Columbia Nut & Bolt Company of Bridgeport manufactures patented iron and steel self-locking nuts, its product being sold mainly to railroads for freight and passenger cars and switch signals.

CLOSE TO CENTURY MARK AND STILL IN HARNESS

The Country's Oldest Living Bolt Maker

CHARLES H. CLARK,
President of the Clark Bros. Bolt Co.

Mr. Clark was born in Milldale (town of Southington) 93 years ago and has been a manufacturer of bolts and nuts for seventy-one years.

The Foster Merriam Company, of Meriden, Conn., makers of brass and gray iron castings may also be particularly mentioned in this chapter as they are among the first in the country to make casters. The first manufacture of these articles, later to be more widely carried on in New Britain, was in West Hartford in 1834 and the firm which later became the Foster Merriam Company was started in Crow Hollow near Meriden within the next year or two. It seems safe to record it as the oldest survivor of its line. The founders were all of New Britain. At first the entire output did not exceed 50 pair of casters a day. The panic of 1837, in which the brass clock industry saved the brass interests near Waterbury, swept away the entire business of this more isolated firm. Every credit customer failed, not one paying more than 50 cents on the dollar, and many nothing. The shop closed for a few months, but later met every obligation in full. Business continued very discouraging until 1840, two of the original partners in the meantime withdrawing. But later Alanson Watrous became interested in the firm and added another foundry. Drop handles and small furniture hardware of various sorts were added to its products, and in 1880 the firm could boast of an output of 9000 sets of casters a day. Recently gray iron castings have engaged more of its interest than brass.

An old and important firm closely allied with the New Britain builders' hardware and tool industry is the Peck, Stowe & Wilcox Company of Southington, a union of three earlier companies. In 1819 Seth Peck patented a folding machine for the manufacture of tinware and established a tinware factory

at Southington. With remarkable initiative and foresightedness he soon built a country-wide business, establishing agencies throughout New England, New York, Pennsylvania, West Virginia, North Carolina, Tennessee, Kentucky and Alabama, an accomplishment all the more remarkable when we consider that this was before the day of railroads. Acquiring additional patents in 1831, Peck organized his business into Seth Peck and Company. In 1833 a new concern, Peck, Smith and Company, was formed and manufactured sheet metal machinery, royalties being paid to Seth Peck and Company for patent rights. In 1843 Seth Peck died and five years later Peck, Stowe and Company changed its name to the Peck, Smith Manufacturing Company and added the manufacture of monkey wrenches.

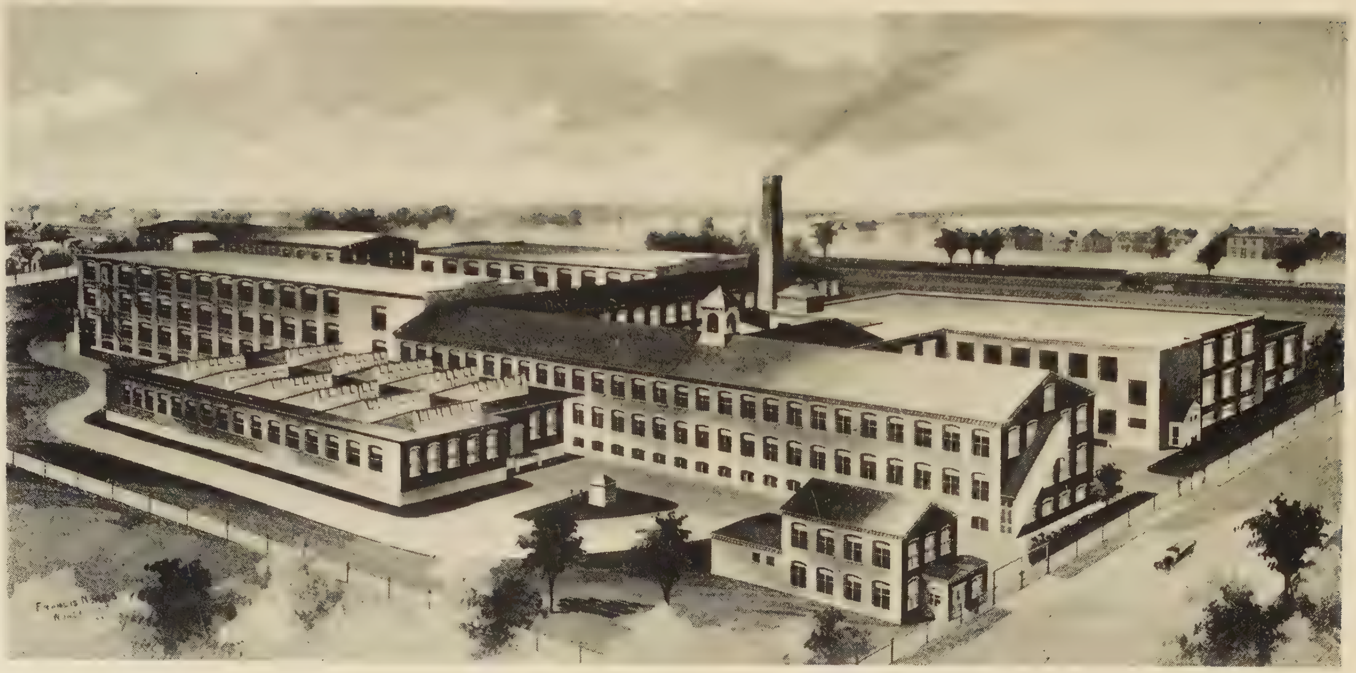
About 1833, Romeo Lowrey, formerly associated with Seth Peck and Company, organized the firm of Plant, Neal and Company in Plantsville for the purpose of manufacturing tinsmith's tools and machines. It was here, a few years later, that the Moore's double seamer was introduced. In 1834 Solomon Stowe erected a small plant in Plantsville and started to manufacture brass gear wheels and other parts for machines for Seth Peck and Company. In 1849 he took his two sons into the business and organized under the name of S. Stowe and Sons. His output now developed into a full line of sheet metal working machines and beaded machines. A few years later the firm absorbed Plant, Neal and Company. In 1852 S. Stowe and Sons became a joint stock corporation under the name of S. Stowe Manufacturing Company. In 1816 the J. and E. North Company was formed by Jedidiah and Edmund North of Berlin for the manu-

facture of tools and machines. This company is noteworthy beause of the large number of future manufacturers who were trained in its plant. In 1823, William Bulkley, Sr., a former North employee, organized with his brother Justus, the J. & W. Bulkley Company. Justus Bulkley died in 1844 and soon afterwards the firm was sold to Lyman Wilcox and the two William Bulkleys, father and son, made tinsmiths' tools until the death of the father in 1878. They were the first to form snips and bench shears in dies. The dies consisted of a small block of steel bearing the impression of the snips or bent shears on the side opposite the cutting edge. Steel was heated to a white heat, placed in the die and the plate was formed by hammering the steel into the die by hand hammer. This process gave the snips and bent shears practically as perfect lines on the outside as the present method of forming them in a drop forge. For many years the Bulkley snips commanded the admiration of snip makers and users throughout the world. It is believed by many authorities that this invention of the Bulkleys was the first step toward the modern drop forge. The Bulkleys were so jealous of their secret that when anyone approached the factory they would slip the die off the block into the half-hogshead of water which they used in tempering and proceed with the making of snips in the old fashioned way by hammering them out by hand.

Meanwhile, Franklin Roys and Josiah Wilcox, who had also learned the trade from the Norths, had set up a factory at North Greenwich. In 1840, Franklin Roys returned to Berlin and started F. Roys & Company. His old partner, Josiah Wilcox remained at North

Greenwich and made tools for the S. Stowe Manufacturing Company. The F. Roys & Company began by making tinners' tools in a shop owned by Noah C. Smith. The building had been previously used as a carriage factory. A limited partnership came into existence a short time later under the name of Roys & Wilcox Company. In 1847 they purchased the Brandegee Cotton Mill property on the Mattahasset River and formed a joint stock company continuing under the same name of Roys & Wilcox Company. It is claimed that the first squaring shears ever made in the United States were constructed by this company and were hand operated. They were fastened to the bench and were operated by a hand lever in the same manner in which photographs are trimmed at the present date. In 1852 a new squaring shear was put on the market by this company, which was very heavy, with a rotary lever motion and was operated by a foot treadle. This freed both hands of the operator so that he could better manage the sheets and cut more work with greater accuracy than with the old method. The next improvement in squaring shears was in their capacity to cut longer lengths and heavier materials.

With the outbreak of the Civil War large Government contracts for bayonets were given to Peck, Smith & Company. Following the close of the war the company was forced to return to its pre-war products. Competition was found to be very strong. Neal, then the president of Peck, Smith & Company, negotiated with the S. Stowe Manufacturing Company of Plantsville and Roys & Wilcox Company of Berlin, resulting in the formation of the Peck, Stowe & Wilcox Company in 1870. The capital was largely increased and the new



Southington Hardware Company, Southington, Conn.

organization centered itself in Southington where it has remained ever since. The capital stock of the new company was $1,500,000, there being at that time only one other company in the State, The Willimantic Thread Company equally capitalized. One of the famous products of this company is the brace, many different models being developed in successive years.

Peck, Stowe & Wilcox now makes, under its "Pexto" trade-mark, a full line of builders' hardware such as locks, knobs, and similar trimmings. The business is carried on by the Builders' Hardware Division of the company. The mechanics' hand tools include braces, augers, bits, pliers, chisels, wrenches, pruning shears, drawing knives, hammers, etc.

The Southington Hardware Company manufactures wood screws, steel squares and a wide line of carpenter's tools. This concern was organized as the Southington Cutlery Company in 1867. The manufacture of Cutlery was discontinued in 1905 and the name was changed in 1908. Under the leadership of James H. Pratt, who has been president since 1910, frequent plant additions have been made until today the Southington Hardware Company is the second largest industry in Southington from the standpoint of the number of employees.

To the New Britain hardware industry America owes the fact that its hardware is now accepted as the best in the world. Although as late as 1840 domestic hardware could scarcely be sold, even in this country, except under foreign labels, it is now preferred both here and abroad. In 1864 Bishop in his "History of American Manufactures" (II p. 753) pays this tribute to New Britain: "New Britain is distinguished for the intelligent enterprise of its inhabitants who, without water

privileges of any amount or any peculiar natural advantage, have established a great variety of important manufactories." He mentions particularly in this connection the "200 page catalogue issued by Russell & Erwin Manufacturing Company, makers of locks and miscellaneous hardware."

Two companies should be mentioned in this connection which, while isolated from the New Britain district, manufacture a type of builders' equipment—the Richmond Radiator Company of Norwich, and the Belknap Manufacturing Company of Bridgeport. The former company dates from 1867, when the Richmond Stove Company was incorporated to make stoves, ranges, and warm air furnaces. A few years later Werter C. Higgins became an officer and inaugurated the manufacture of steam and hot water heating boilers, which he designed and patented. The company was successful under his management, but after his retirement in 1897 it passed through various hands and was acquired by its present owners at a receivers' sale in 1912. It now makes "Richmond" and "Model" Boilers for steam and hot water heating. The main office of the company is in New York.

A unique and historic industrial institution is the famous Collins Company located at Collinsville. This concern which may truthfully boast that "its axes hewed the way to the Pacific Coast," was founded in Hartford in 1826 by Samuel W. Collins, a merchant of the town. Convinced of the need for good axes, he started to manufacture them in a little stone shop in that city. Soon afterward he moved the plant to Canton at a site on the Farmington River, now called in his honor Collinsville. His diary, still in existence, describes the

earliest struggles of the little plant and its quick growth. In 1828 appears this entry, "Contracted with Oliver Couch to take his four-horse stage off the Albany turnpike and run through Collinsville to Farmington and Hartford, and so got a post office established in Collinsville." The same year finds in the record "Built the first trip hammer shop," and "Commenced drawing axe patterns and making broad axes with trip hammer. Each man tempered his own, forging and tempering eight axes per day." His chief difficulty seems to have been to secure a uniform quality of steel for the bits of the tools and he soon started a crucible steel plant to maintain a perfect quality. It is a tradition at the plant that the firm's entire resources were kept at the shop in an old cigar box, and at first doubtless there was little left for the owner after the weekly expenses were paid.

But this stage soon passed. The rapid growth of the country westward soon after the enterprise was established, culminating in the Gold Rush 1849–1850 kept the plant expanding, for every pioneer must carry his axes and tools, and Collins and Company was the first to supply the markets of this country with cast steel axes, ground ready for use. Other edge tools were added to the product and later Collins plows became famous. One old account relates that the manufacture was "carried on with much ingenious labor-saving machinery, mostly invented and constructed by the Collins Brothers." As early as 1872, 600 men were employed turning out 3000 axes and 100 plows a day, at a time when such quantity production was almost unheard of. By 1859 the "New American Encyclopedia," so proudly issued in that year by Appleton, states that "the largest

establishment in the world manufacturing axes and edge tools is that of Collins & Company, situated on the Farmington River at Collinsville, Conn." For many years the original trade-mark "Collins & Company, Hartford" was retained. So valuable did this become that it was widely copied on edge-tools, especially those intended for export. This often resulted in litigation. Not content with seeing their axes hewing the way to new settlements, their picks rending in the California gold fields, they soon entered the export field. Here, too, they won instant popularity, both on account of the quality of the tools and the fact that the company made a specialty of catering to peculiar local needs and tastes in foreign countries. For instance, Brazilian axes did not have holes punched, but were welded, since a Brazilian likes to insert a rough round stock for a handle. A peculiar type of curved edge hoe is made for more remote South American trade, for no particular reason except the Colombians and their neighbors *like* the hoe that way. Special tools, vicious-looking curved sharp implements for rubber and turpentine gatherers, miners' knives, sugar-cane knives, cleavers, strange tropical knives used for cutting cane, brush or undergrowth; deadly machettes for Latin countries, especially those parts of Central and South America, where no native gentleman feels equipped for business or a social engagement unless armed with this popular weapon—these are samples from the museum of this famous concern. A recent display of the Collins Company products was a veritable nightmare of glittering knives and edge tools, of weird and fantastic design. It is a recognized fact that "Collins" knives and

other Collins products are the only makes that will even be accepted in many foreign countries—hence the trade-mark infringements. The company is acknowledged to be the greatest edge tool exporter in the world.

It was this company, also, that first replaced the cast-iron plow with the lighter, smoother "cast-steel" implement, and hundreds of thousands of them were marketed. It was, likewise, among the first to adopt the principles of quantity production, division of labor and a rigid inspection system. A few years ago a branch plant was established in Lewistown, Pennsylvania, the company transfering to the new plant its own foreman and many of its workmen, in order to secure uniformity of quality. It now has about 1,200 employees.

A once famous Connecticut tool which has now passed into history was the "Scovil Hoe," made in Haddam in the middle of the last century in great numbers and enjoying an enviable reputation and popularity, especially in the South where the plantation negroes particularly cherished their "Scovils." The maker, who had learned the metal trade from Eli Whitney by making gun barrels, was struck while travelling in the South with the inferiority of the plantation agricultural implements. Returning to Haddam he started a factory for the manufacture of hoes, which flourished there for many years.

Aside from the Collins Company, the center for edge tools in Connecticut is Winsted. Of the less than 25 factories of the town, seven of the largest are makers of edge tools and pins. The location of the industry there probably may be traced to the shop of Jenkins & Boyd, erected in 1792 for welding, drawing, and plating

scythes. This was done by water power under a trip hammer, the grinding being on geared stones. Previous to this undertaking scythes had been made laboriously by hand, wrought in smithies and ground on stones, turned by hand. The making of axes too, had become a distinct trade there by 1804, Elizur Hinsdale, being the earliest maker. It is likely that this interest in metals spread to Winsted because of its nearness to the Salisbury Iron Works.

In 1828 Nathaniel B. Gaylord, the owner of the old Jenkins Scythe Works, began to manufacture axes under the supervision of one of the original workers in the Collins Company, Marcus Morgan, who later purchased the company. He in turn, sold it to others, who built a dam and factory and reverted to the production of the original product, scythes. This became the present Winsted Manufacturing Company. The company now manufactures scythes, knives and other edge tools.

In 1852 a Winsted joint stock company, called The Eagle Works, was formed to manufacture cutlery, later becoming the Empire Knife Company, when it was taken over by Beardsley & Alvord. It has since been purchased by New York interests and employs about 100 hands. A few years later the Winsted Hoe Company was formed, now the Winsted Edge Tool Works, manufacturing chisels, drawing knives, etc.

A cutlery company somewhat removed from the edge tool centers is the Challenge Cutlery Corporation of Bridgeport, producing pocket knives. It has about 100 employees, and a normal production of 80,000 dozen pocket knives.

No survey of Connecticut hardware should omit the

HENRY R. TOWNE

Born in Philadelphia, Pa., August 28, 1844, and died in New York City, October 15, 1924. He entered the University of Pennsylvania in 1861, but left at the beginning of the Civil War to enter the employ of the Port Richmond Iron Works where, at the age of 20 years, he assembled and erected the engines and machinery of several monitors and a cruiser in the United States Navy. Later, at the close of the war, he took a special course at the Sorbonne, Paris. Henry R. Towne was the active founder of the Yale & Towne Manufacturing Company in 1868, and for over fifty years was its leading figure. He was a past President of the American Society of Mechanical Engineers, of the Merchants Association of New York, and one of the first directors of the New York Federal Reserve Bank.

Henry R. Towne.

W. & B. Douglas Company of Middletown. During the latter part of the last century the town was noted for the famous Douglas pumps, the invention of two brothers, descendents of Col. William Douglas of Revolutionary fame. The pump was the first metal pump made, supplanting the old creaking wooden contrivance which was then to be found in every farm yard. The brothers at first sold their output themselves, carrying them from door to door, disposing of 300 pumps in the first year. In a short time, however, success was assured and the manufacture was extended to hydraulic rams. The company at one time sold its products all over the United States and exported widely.

Another interesting type of hardware in which Connecticut has established and retained preëminence is locks, which have been already referred to in the account of the American Hardware Corporation. The invention and improvement of locks is a story of peculiar romance, associated as it is with wealth and treasure, but too long to be told here. It may be found in a volume now out of print entitled "Price, On Locks."

The Eagle Lock Company of Terryville was established in 1853, being the combination of two lock manufactories, the Lewis Lock Company and the James Terry Company. The Lewis Lock Company was the successor of Lewis McKee & Company which had purchased the ill-fated venture of Stephen G. Bucknall, already referred to as the original lock maker of the country. The Lewis Lock Company, one of whose original partners was Eli Terry, Jr., was moved to Terryville. Its advance was pathetically slow, as its income failed to warrant expenditure for new equipment. For many years it had no engine lathe, and for thirty years

no planer. Hoes were forged by hand and faced by hand files. Hand presses were used in cutting out the parts of the locks, but power presses were invented and applied in the shop years before the industry elsewhere used them. Lock plates were imported with selvages already bent, because they could be bought cheaper than the raw material. On the death of Terry the company failed and was sold for six cents on the dollar.

Both the parent concerns had suffered constantly from financial embarrassment, lack of tools, and, most of all, from popular prejudice against the domestic product. By the time the Eagle Lock Company was well under way, however, with its added capital and improved equipment, domestic hardware had become more acceptable. At the period of the Civil War the company was employing about 200 hands and turning out 20,000 locks with keys per day. They bought out the Fitch Manufacturing Company of New Haven, and were the makers of the standard American lock of the period. They even carried on an export trade. Prosperity has rewarded persistance and able management and the company is now a $5,000,000 concern.

Undoubtedly the most familiar and noteworthy name in the lock world, however, is "Yale," made famous by the products of the Yale & Towne Manufacturing Company of Stamford. It was in the little hamlet of Newport, in Herkimer County, New York, about twelve miles northeast of Utica, that this name was first used in connection with locks and hardware. Linus Yale, Sr., was born in Middletown, Connecticut, in 1797, but reared in Herkimer County, New York, and had a natural talent for mechanics which first bore fruit in improvements in various milling devices. Later, it led

him into designing and making bank locks, which, in those days, were always operated by keys, and were usually of more or less intricate construction.

It appears that about 1840 he started as a lock maker and that in 1847 he built, in Newport, New York, the substantial stone building, still standing, and known locally as the "Yale Lock Shop." In that year he brought out a "Yale Bank Lock," the first of the long line of locks destined to bear that trade-name and a masterpiece of ingenuity. This was followed by a number of locks for use on doors, drawers and for similar purposes. These were all of high security and marked mechanical excellence, and higher in price than the locks then in common use. After the death of Linus Yale, Sr., in 1857, the manufacture of Yale Locks at Newport was continued by his successors, whose interests were ultimately transferred to The Yale & Towne Manufacturing Company. Linus Yale, Jr., was born in Salisbury, New York, in 1821, and began his career as an artist, but soon gave rein to his inherited aptitude for mechanics by following in his father's footsteps as a designer and maker of locks. His first endeavors in this field were in his father's factory. Later, about 1855, he started in business for himself.

Linus Yale, Sr., was the first man to make use of the "pin tumbler" locks, an adaptation of an ancient Egyptian lock of marked mechanical excellence; and his son, by combining it with a small revolving "plug," made possible the use of the flat key. He became one of the leading bank lock experts of his day, producing a series of the large and intricate locks and keys at that time in use, and called them "Yale Locks" naming them in the order of production the "Infallible," "Magic,"

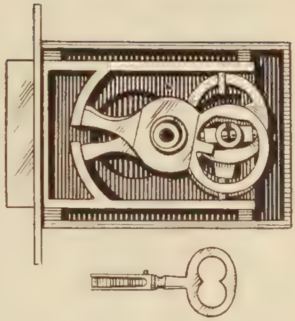
"Double Treasury," "Monitor" (the first to foreshadow the dial lock) and "Double Dial."

The famous "lock controversy" which arose in England, when an American, Hobbs, succeeded in picking the best English bank locks, lead to similar contests in this country. Being drawn into one of these, Linus Yale, Jr., first picked the English so-called "Hobbs Lock," then his own best lock, and finally demonstrated that any lock with a keyhole could be picked by one with skill, implements and patience. As a result, he concentrated his attention on developing the combination or dial lock, which had been in use in a crude form for centuries, and so perfected it that before his death it had largely displaced all other locks for banks and safe use.

From 1860 to 1864 Yale turned his ingenuity upon the problem of household locks. Up to that time all keys were round and most of them were long and heavy, the length being whatever was necessary to reach through the door to the lock mechanism on the other side. The weight and awkward bulk of a bunch of keys at that time can hardly now be realized, but one has only to recall pictures of the housewife of that time carrying her keys over her arm in a basket, or the "turnkey" with his great jangling ring hanging low from his belt. Yale's supreme contribution was combining the pin tumbler and revolving plug principle in a type of lock which permitted the use of the flat keys of uniform length for ordinary purposes, and at the same time afforded greater security. It also provided a greater capacity for key changes than any other system. The same improvement led to a standard design and workmanship in the smooth delicate little house keys.

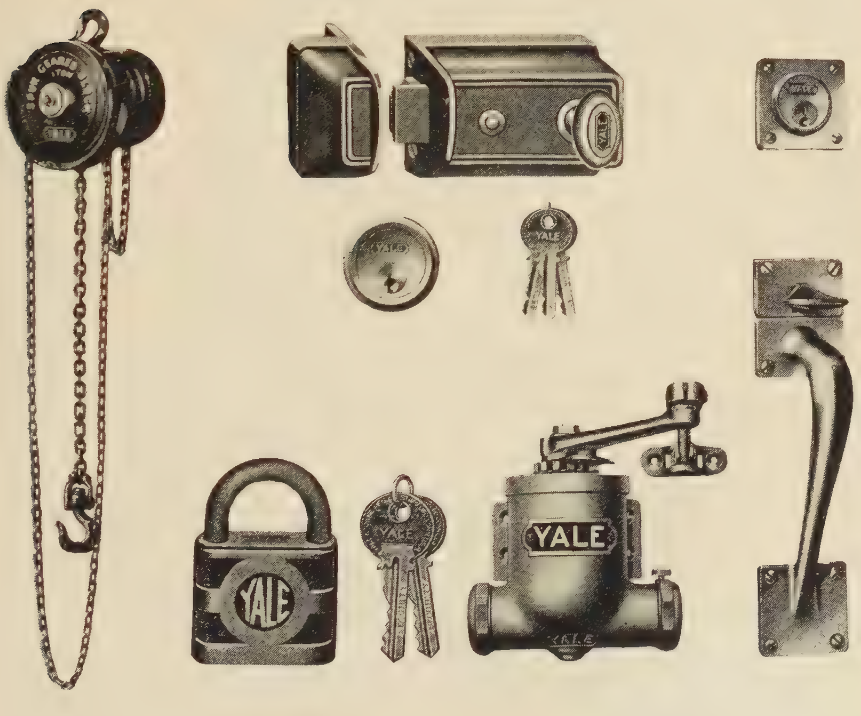
Meantime, in another place, another series of events

Linus Yale, Jr.



One of the First YALE Locks

Some Products of the Present YALE Line



Insert Shows the Works in 1870.

apparently unconnected with those just related, was destined to merge with them and to contribute to the final outcome. In Philadelphia, during the critical period of the Civil War, a young man, Henry R. Towne, had begun his career as a student of mechanical engineering in the Port Richmond Iron Works; had worked his way through the drawing room and shops; and finally had been given charge of the erection, in place, of the machinery of two of the then novel "monitors," the largest of their class, the machinery for which the firm had built under contract with the Navy Department and from the designs of Captain John Ericsson. That work was completed in 1865, and thereupon young Towne desiring to qualify himself further as mechanical engineer, made a tour of engineering establishments in Europe, studied at the Sorbonne, Paris, took a special technical course under the late Robert Briggs, C. E., and a practical course in the shops of William Sellers & Company, both of Philadelphia, and then began to look for a permanent business connection.

Thus in 1868, when Linus Yale, Jr., was looking for an associate qualified to organize and manage the manufacturing operations of his business and to contribute additional capital to it, Henry R. Towne was likewise seeking a field for his training and resources. The late William Sellers, a noted mechanical engineer, and a friend of both, brought them together, and in October, 1868, they organized a corporation to conduct the business, selected a site in Stamford, and began the erection of a modest factory building, which is still in use. In 1868, Yale died suddenly in New York, before the new enterprise had started on its career. In March, 1869, the new factory being completed, the business was transferred to

it, the employees numbering about thirty. In the years which followed, the business grew steadily, and the plant has been enlarged almost annually to keep pace with it.

The now familiar "time locks," whose inexorable security sometimes bears fruit in tragedy, and which have taken their place in fiction and the drama—as witness "Alias Jimmy Valentine"—were first introduced by this company in 1874. These are made possible by the adoption of a bolt mechanism, controlled by two or more clock movements so arranged that no one, not even authorized officials of the bank, can open the vaults until the predetermined moment has arrived. Today practically every bank vault is so protected.

At about the same time the now familiar metal-front post-office "lock box" was introduced, leading to the manufacture by them of the entire post-office box equipment. The company also developed the invention of a differential pulley block, and thereby built up a block and crane business, thus establishing the first crane building specialty in the country, including locomotive, travelling and other types. This department of the business was sold in 1894, but the Hoist Department still carries on the manufacture of smaller blocks, the screw-geared chain block, the electric hoist and the differential block.

It would be impracticable in this volume to describe the many new locks which have been invented or perfected, and put on the market by these great lock manufacturers. The company is considered the largest producer in the world of locks, bank locks, night latches, padlocks, and chain blocks. For more than forty years it has furnished all the lock boxes used in the United

OVER 40 YEARS OF "GENUINE ARMSTRONG" TOOLS IN EXPOSITIONS.
THE ARMSTRONG MFG. CO., INC., BRIDGEPORT, CONN.

1880

1924

States Post Offices located in Government buildings and has furnished such boxes to many foreign Governments. It has from four to five thousand employees and fifty-eight buildings. To the original products new lines were added from time to time, beginning in 1873 with fine bronze builders' hardware. Today upward of 30,000,000 separate articles are annually turned out, each bearing the "Yale" trade-mark in one of its usual forms.

The plant now occupies upward of twenty acres of ground, covered with buildings of modern and substantial character, and employs approximately 5,000 persons. The company also operates a plant in St. Catherines, Ontario, and in Altona, Germany, for supplying their Canadian and European trade, respectively.

Within Connecticut's borders is one of the world's leading manufacturers of a specialized line of builders' tools—the Armstrong Manufacturing Company of Bridgeport, which makes plumbers' and steamfitters' products. Founded in 1870 by Frank Armstrong and Henry House, this concern has risen to a world position whereby its product has been sold in every country in the world. In each of these countries, its two trade marks are registered. Although making a number of pipe-cutting and threading machines, its chief product is an adjustable stock and die by which it is possible to cut and thread many different sizes of pipes, both iron and brass. The company also makes a ceiling nipple threader whereby it is possible to cut and thread pipes without removing them from the walls of a building. This device was the invention of the late Charles H.

Armstrong, whose widow is today secretary and treasurer of the company. The Armstrong Manufacturing Company has won many prizes at expositions both in this country and abroad. It has won first prize at each of these expositions. During the war, the company supplied the Army and Navy with much material.

The Baird Machine Company of Bridgeport was founded in 1846 by Joseph H. Baird to manufacture automatic tools. Compared with the tools manufactured today, the early output of the company was of a comparatively simple construction. The Baird organization manufactures tools that are used to produce hundreds of articles in daily use that are made of wire and of metal ribbon—such as pins, hooks and eyes, metal buttons, snap fasteners, can and bottle openers, chains, springs, rings, pen and pencil parts, hinges, all kinds of toilet, safety, hair, broach, badge, blanket and many other common pins. In addition to the tools used in the manufacture of the foregoing articles, this firm is now engaged in the manufacture of home heaters, such as hot water, steam, vapor and hot air furnaces. During the war the Baird Machine Company was engaged in building machines used in making cartridge parts, clips and the metal parts used on uniforms, wire for tenting, wire machines for making chains for artillery harnesses, and wire forms used for holding powder bags in trench mortars. The company also made machine tools which were used in the production of machinery, and machine tools which were used in making large sized guns and rifles. The Baird Machine Company is one of a very few concerns engaged in the manufacture of automatic machine tools at the present time in the United States.

PLANT OF THE BAIRD MACHINE COMPANY,
BRIDGEPORT, CONN.

Office, first floor — Engineering Dept., second floor

Main workshop, center

Machines of exceedingly high speed are used throughout the factory.

We have just seen how certain makers of builders' hardware and tools have grown up in the Southeastern portion of Fairfield County, relatively remote from the New Britain hive. In New Haven is located another important concern of a similar character, which is of peculiar historical interest. This is the great firm of Sargent & Company. It is another of those Connecticut concerns whose ownership and control revolve about a single family name; and, as we shall see, there is a New Britain strain in its business lineage.

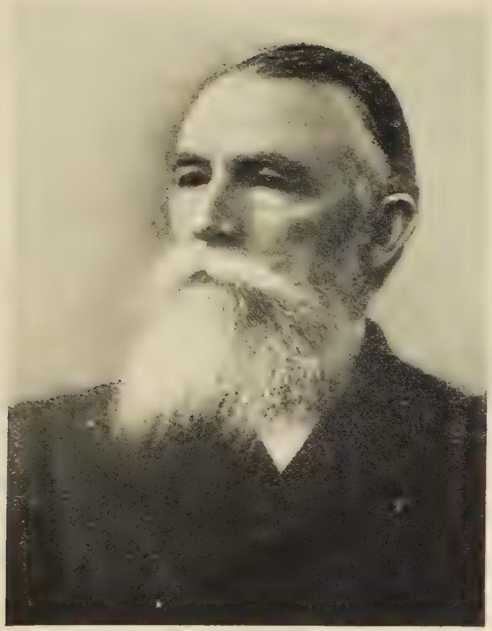
To find its beginnings we have to go back more than a century to the hill-town of Leicester, Massachusetts. It was here, in the year 1813, that Joseph Denny Sargent, whose ancestors had come from Northampton, England, seven generations before, began on his farm to manufacture the hand cards which were employed in the home spinning prevalent at that period. This business had been established in Leicester three years before by Captain Isaac Southgate and Col. Henry Sargent, an older brother of Joseph Denny Sargent, under the firm name of Southgate & Sargent. At one time the two brothers were in partnership, but the association was dissolved and Joseph Denny Sargent continued to carry on his branch of the business until his death in 1849.

Of the several sons of this Sargent, one, Joseph Bradford, in his youth emigrated to Griffin, Georgia, where with an older brother he built up and conducted a successful mercantile business, amassing by thrift and hard work a modest fortune of about $10,000. This became the foundation of the great Sargent interests of today. At about the time of his father's death in 1849, Joseph

Bradford Sargent moved to New York City, established a commission business, and in the course of the settlement of the paternal estate, bought a half interest in the Leicester card manufacturing business. Shortly afterwards he bought his partner's interest in that industry. To raise the funds for this purpose he applied to the president of a Leicester bank who had known him from boyhood. This account of the transaction has come down to us: "In his own way he told the story of his experience, savings, and plans. He had no endorser to offer; he could not then tell when he could pay the loan; but could say that if he lived he would pay it at some time. As he finished his story—it was told at the banker's residence—the latter stopped in his thoughtful, listening attitude as he paced the floor, and said;—'well, Joseph, I will lend you the money, and you may pay it when you can.' "

Sargent removed the business for a time to Williamsburg, New York, in order that both his mercantile and his industrial business might receive his personal attention; but later on, when his youngest brother, Edward Sargent, was taken into the concern and the firm name of Sargent & Brother given to the business, the manufactory was moved back to the little brick shop at Sargent Pond in Leicester, with the junior partner in charge of production.

It is interesting to note how this Joseph Bradford Sargent was thus gradually learning the great arts of producing and selling. His fidelity to family ties is also striking, for five years later, in 1854, we see him bringing to New York another brother, George Henry, and establishing the New York sales firm of Sargent Brother & Company, later changed to Sargent & Com-



Joseph Bradford Sargent
1864–1907—Pres. S. & Co., New Haven, 43 years.
1849–1907—Continuous service 58 years.

George Henry Sargent
1852–1917—Continuous service 65 years.
1907–1917—President, 10 years.

George Henry Sargent, George Munson, William John Ladd, Thomas Jessup Atkins. All of New York. 204 years total continuous service.

OFFICERS AND BOARD OF DIRECTORS 1925

Sitting (left to right) Murray Sargent, Sec'y. Other officers and directors: Edward Rupert Sargent; Bruce Fenn, Vice-Pres.; Henry Bradford Sargent, Pres. Conn. Co. and Ills. Co.; George Lewis Sargent, Vice-Pres.; Wilfred Lewis; Joseph Denny Sargent. Standing: Ziegler Sargent, Treas., George Frederick Wiepert; John Sargent, Pres. N. Y. Co.

pany. Each of the two lines of business prospered, and other allied ventures not of immediate interest to this account were entered into.

The stage was now set for what was to become the great achievement of his career. He had inherited and acquired a bent for manufacturing, and he had mastered salesmanship and marketing. He could also both save and command capital. It was through a New Britain avenue that he drifted into the builders' hardware line. At about 1842 one Elnathan Peck, a well-to-do New Britain carpenter and builder, began the manufacture of andirons, fire dogs, and some smaller articles of hardware, forming with his brother-in-law the firm of Peck & Dewey, which later, with the entry into the business of Henry Walter, a trained manufacturing jeweler, became the corporation entitled The Peck & Walter Manufacturing Company. This company was capitalized for $100,000, of which Joseph Bradford Sargent purchased a tenth interest.

In the panic of 1857 the Peck & Walter concern went under, and Sargent became the largest creditor and a majority stockholder. Again associating with himself his two brothers—Edward and George H.—he reëstablished and continued the business as J. B. Sargent & Company. The enterprise prospered and, as upon another occasion when New Britain lost what was later to become the great General Electric Company, so now did it lose the great Sargent plant. The story of the concern recites that "more factory space was urgently demanded, and finding no convenient land available in New Britain, and after search elsewhere, he soon bought a vacant city square with harbor frontage, in New Haven, Connecti-

cut; contracted for the year's capacity of all the active brick yards in New Haven and Hartford Counties; bought all of the other necessary building material; and proceeded to cover said city square with an up-to-date brick, timber and plank manufacturing plant, exciting many to inquire whether or not extravagance had replaced thrift in his mind."

On May 1, 1864, hardware production began in the new plant, which covered something more than two acres, about 100 of the employees' families moving to New Haven with the business. The local newspapers printed many estimates as to the probable number of employees required. It was not long before extensive enlargements were demanded by the continually increasing business, and beginning with the year 1869 there have been many periods of large expansion.

Through its New York commission house, Sargent & Company drifted into the manufacture of locks on a large scale. The New York house had marketed, as authorized agents, the products of Mallory, Wheeler & Company of New Haven, makers of locks, knobs, escutcheons and padlocks. Under this arrangement there was mutual prosperity and large expansion of the business; but in 1878, following the death of Burton Mallory, new management assumed charge of the Mallory concern, which in the meantime had become Davenport, Mallory & Company; and Sargent & Company of New York complained of repeated violations of the articles of agreement. In 1882 came the break, and thereafter, to supply the well-established trade of the house in that line, the Sargents themselves entered upon the manufacture of locks on a large scale, developing a fundamental line of door locks, latches, knobs and escutcheons. Thus


SARGENT & Co.
NEW HAVEN, CONN, U S A
Hardware Manufacturers.

there came to be established in this field a distinct "Sargent" line. The Mallory interests have, in the meantime, been dissipated, the patterns sold, and their buildings occupied by other lines of business.

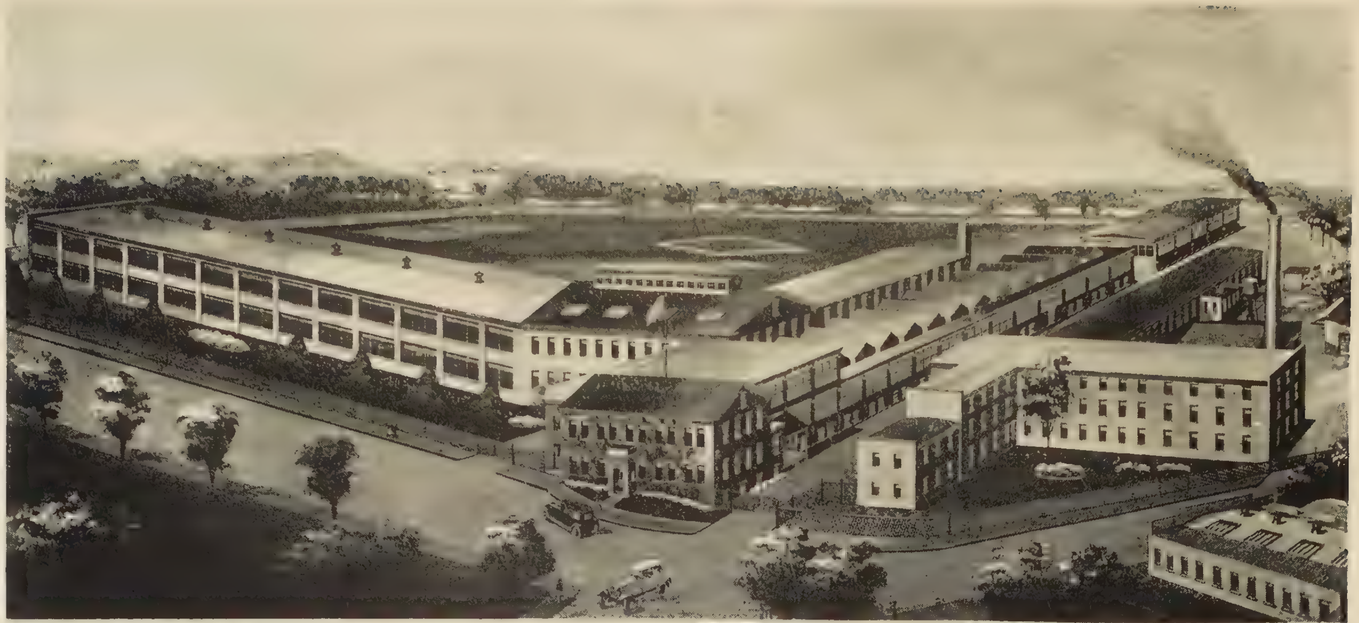
Sargent & Company is now one of the country's leading producers of articles classed by the trade as "shelf hardware," including hardware for doors, windows and other parts involved in building. Its factory premises comprise more than twenty acres of covered floors, located on land much of which has been reclaimed. When incorporated in 1864, it had a capital stock of $300,000. On January 1st, 1925, it had capital, surplus and undivided profits of more than $8,000,000, including its subsidiary merchandising concerns of the same name in New York and Chicago. From its cradle in the modest hand carding enterprise at Leicester, through its wanderings to the South, to New York City, and to the hardware touchstone of New Britain, until it finally found a permanent home on the water-front of the City of Elms, it has been at all times a distinctly "Sargent" institution, and it is still presided over and actively directed by a son of the great master organizer, Henry Bradford Sargent.

The brass industry developing simultaneously in the nearby Naugatuck Valley should doubtless be considered a development independent of the builders hardware trade, but during recent years the two great metal trades have had mutual interests, the brass companies frequently making "blanks" for the appliances of the distinctive hardware manufacturers. In some cases it is difficult to decide into which class the newer companies should be grouped, their products overlapping.

A comparatively recent, but relatively important, con-

cern engaged in the production of high-grade specialized tools is the Geometric Tool Company of New Haven. The site of this concern's plant under the protecting cliffs of historic West Rock has long been used for manufacturing purposes. More than sixty years ago Anson Beecher there made baskets in what is now the Blake Street building of the Geometric factories, under the firm name of the Beecher Basket Company. Later on, in the same building the manufacture of matches was carried on by Anson Beecher & Sons Company, the business being later consolidated with Swift & Courtney Company of Wilmington, Delaware, under the name of the Swift & Courtney and Beecher Company. The business took its flight from Connecticut when the company was absorbed by the Diamond Match Company. The four Beecher sons, however, continued to occupy the old building and maintained offices there until, one by one, death claimed them.

Among the smaller enterprises supported by Ebenezer Beecher in the early Nineties was the Geometric Drill Company, which had been organized to manufacture and market an invention of William J. Smith of Wilmington, Delaware. Smith's device was a drilling machine that would drill or bore irregular-shaped holes. While it was an ingenious mechanism, the demand for it was so limited that the company failed to prosper. At this juncture, early in 1896, Howard E. Adt, who had been trained in the practical school of the factory of John Adt & Son in New Haven, entered the Geometric Drill Company's organization. Realizing that a change and enlargement of its line of products was necessary to the success of the company, Adt was responsible for the development of the quick-opening die head for pro-



THE GEOMETRIC TOOL CO.

NEW HAVEN, CONN.

duction thread-cutting and the collapsing tap. The business responded quickly to this new line, and in 1905 the company was re-organized under its present name. Its specialized output is known throughout the civilized world, wherever thread cutting on any extended scale is done.

Those who may have found this chapter of sufficient interest to complete its pages cannot have failed to secure a new and added appreciation of the extent to which Connecticut has contributed during the past century to the better housing of the human race. Uncounted millions of hands throughout the civilized world have turned her knobs, snapped her locks and swung her hinges. Innumerable family boards have been served by her cutlery, and the controlled arm and steady eye of myriads of woodsmen and housebuilders have driven and directed her tools.

SILVER AND SILVER PLATE

DURING the seventeenth century, it was a mark of social distinction to own silver, the tableware of the poor being of wood, pewter, or tin. Practically all silver was "sterling" or "pure coin," as the art of combining silver with any other metal or of plating was not discovered until the middle of the next century. As in the case of practically all other skilled trades, the earliest silversmiths in the colonies either learned their trade in England or were taught by English craftsmen. Hence the comparative rarity and consequent high value of silver at the time. Most of this early silver was in the simplest forms: Teaspoons, rat-tailed and plain handled; a very few forks—two-tined, of course; beakers; cups, cream jugs, pepper castors; bowls and porringers, candlesticks and, occasionally in the homes of the very rich, tea and coffee services and great silver punch bowls.

It should be explained at the outset that silver and plated ware are divided into two classes—flatware and hollow-ware, the former being such utensils as forks, knives and spoons, and the latter such as tea and coffee services, dishes and bowls. For churches, simple but exquisitely beautiful baptismal basins, communion services and caudle-cups were made. Many of these are still owned by the white Congregational churches of Connecticut but others, alas, have been melted down or sold as "old silver" to purchase more up-to-date equipment.

Of these larger pieces, the records show that the local Connecticut smiths made very few. The rich and fashionable, then as now, usually preferred to make such

important purchases in New York or Boston, and there are several instances of skilled silversmiths, makers of large pieces in those cities, removing to Connecticut towns and never thereafter having an opportunity to employ their craft beyond the making of teaspoons and an occasional candlestick, cup or porringer. On the other hand, the trade was profitable and nearly every town had its silversmith as well as its blacksmith, who exerted similar strength and greater skill with his hammers, anvils, and planishing hammers, shaping the white metal, hammering it while cold, and many times during the operation stopping to anneal the piece—that is, to heat it in a charcoal fire to toughen it—and then hammering away again.

Like most other manufacturers of the period, the earliest carried little manufactured stock. Ordinarily, actual silver coin was taken to the smith to be fashioned. Coins were melted in a crucible and poured into a skillet to form an ingot, which was then fashioned into the article ordered. Hence the practice of valuing silver plate by saying it contained so many "Spanish dollars" or English coins. A lathe was used, probably worked by foot power. This was not employed for spinning but for shaping and truing the hollow pieces, such as bowls or beakers—this, of course, only after the hammers and anvils had done their work. Finally with planishing hammers, rotten stone and burnishers, a beautiful uniform surface was secured and a "feeling" and finish attained to which a machine-made piece, glossed on a buffing wheel, can never aspire.

It was at about 1750 that amalgams and plates such as "German silver," pewter, britannia and tin, began to be made in little workshops; but the sterling production

remained a craft by itself, until in the years of rapid industrial growth from 1810 to 1840 it, too, was absorbed by those silver-plate and German silver factories which the survivors of the early smiths must have scorned.

The earliest American silversmith on record (about 1650) was Captain John Hull, coiner of the "Pine Tree Shilling," mint-master of Massachusetts, a merchant prince. Indeed silversmiths were frequently men of enviable standing and wealth, particularly in Boston, where the finest silver works of the Colonial period was undoubtedly done; as witness Paul Revere, hero of the midnight ride, examples of whose exquisite silverware are now treasured heirlooms or museum exhibits. The silversmiths were then, as now, frequently jewelers, watchmakers and engravers as well. One Jeremiah Dummer (1645–1718), although a Bostonian smith, engraved and printed the first paper currency issued in Connecticut—"6550 sheets," say the records.

Connecticut herself, however, is not lacking in names of smiths rich in historical association,—John Potwine, a Hartford craftsman who made a silver sword for Governor Wolcott; Timothy Bontecou of New Haven, like many other fine smiths a Huguenot refugee, victim of an outrage by a mob of British soldiers in 1779; Ebenezer Chittenden of New Haven, nephew of the first President of Columbia University and also of the first Governor of Vermont; Col. Miles Beach of Hartford and Litchfield, who saw active service in the Revolution and was chief engineer of the Hartford Fire Department from 1789 to 1805.

In other chapters reference has been made to Abel Buell of Killingworth, who was convicted of counterfeiting and branded on the forehead with the

letter "C" before he became of age and who, while in jail, constructed the first lapidary machine for grinding and polishing precious stones—an invention which he used to good advantage by fashioning a ring to be presented to a discreetly chosen official, thereby securing his release. He later made the first type in the colonies and presented a memorial to the Assembly bearing the impression of his own product, requesting aid in erecting a type foundry. To this the legislature turned a deaf ear. He also surveyed the coast of Florida for "Roman's Map of North America" published during the Revolution and was associated with Amos Doolittle, a New Haven engraver, who sketched and engraved four views of the Battle of Lexington, believed to be the first series of historical prints in the country. He constructed a machine for coining copper money for the State, capable of making 120 coins a minute. A few years later while in England he is said to have been consulted and to have been of material assistance in preparing engineering plans for iron bridges, then a radical departure in construction. Through most of his checkered career, not always impeccable in its respectability, he maintained his New Haven business, the advertisements of which reflected the humor of his personality. The following under date of 1806 is typical: "Mariners' and surveyors' compasses and other instruments cleaned and rectified, engraving, seal and die sinking, seal presses, enameled hair worked mourning rings and lockets, fashionable gold rings, earrings and beads, silver, silver plated, gilt, and polished steel buttons, button and other casting moulds, plating mills, printers blocks, coach and sign painting, gilding and varnishing, patterns and models of any sort of

cast work; mills and working models for grinding points as used in Europe, working models of canal locks, drawings on parchment, paper, silk, etc., by Abel Buell, College Street, New Haven, where there is a decent furnished front chamber to let by the week." During the same year he advertised that he had on exhibition "the wonderful negro who is turning white," the genuineness of which phenomenon was vouched for by a no less personage than President Timothy Dwight of Yale.

Two incidents connected with church silver should not be omitted before passing on to the manufacturing stage of the industry. One of the beakers belonging to the Congregational Church of Groton, made by a Rhode Island silversmith, bears the inscription "The Gift of Sr. John Davie to the Church of Christ at Groton." The donor was a son of Humphrey Davie of Hartford, cousin of Sir Wm. Davie of Devon, England. Graduated at Harvard 1681, he was one of the first settlers of Groton and the first town clerk. In 1707 his titled English cousin died without issue and John Davie of Groton succeeded to the baronetcy. The story goes that, barefooted and in his shirtsleeves, he was hoeing corn when the news of his good fortune came. He left at once for England and the beaker was his parting gift. Another story concerns the silver baptismal basin of the Center Congregational Church of New Haven. The story runs that early in the eighteenth century one Jeremiah Atwater of New Haven purchased in Boston a cargo of nails. In one of the kegs beneath a layer of nails, he found a quantity of silver coins. In refutation of the tradition of Yankee super-shrewdness, it is said that he wrote to the Boston merchant from whom the contents of the keg had been bought, asking him to re-

turn the money to the rightful owner, to which the merchant replied that the keg was "bought for nails and sold for nails" and he had no way of returning the treasure-trove. Mr. Atwater, therefore, concluded to absolve his conscience by giving it to the church, and had it wrought into the beautiful silver basin.

Among the most popular silver ornaments of the Colonial period, were the buttons and knee buckles of every gentleman's toilet. And, as appears in the chapter on the brass industry, their manufacture was the beginning of the greater brass industry in the Naugatuck Valley. It was in the shop of a silversmith, Joseph Hopkins of Waterbury, later a Judge of Probate, that these ornaments were first known to have been made there.

About 1800 there were several small silver shops in Hartford, Meriden and Wallingford (then and until 1806 part of Meriden) where spoons, plates, platters and similar ware were made in quantity and sold to the neighboring towns or distributed in the packs of the ubiquitous tin peddlers. Pewter, a mixture of tin and lead in parts 4 to 1, was cast in the form desired, and the compound was "fined" by lathe or hand tools. Being soft and taking a fine lustre when polished, it graced with beauty the Colonial sideboards in many forms of flat and hollow-ware.

The localization of the silver industry in Meriden and Wallingford is interesting. About 1815 Charles Yale, who had been selling tinware in the South, became convinced of the need for a better grade of goods and began to make, in partnership with his brother, Hiram, britannia ware, the formula for which was obtained from English workmen whom they had secured from abroad.

The metal was harder than pewter and took a more brilliant polish and became very popular, although the old fashioned pewter was still widely sold. The Yales had a pretentious factory in Wallingford, considered at that time the largest in its line in the country, making for the most part hollow-ware with a high finish. Their more skilled workmen were brought from abroad and the formula for their britannia, in which antimony was alloyed with tin, was jealously guarded. Up to this time Meriden manufactured tinware, ivory combs, coffee mills, and a few brass and wooden combs for the Southern negro trade. Other silver, pewter, and britannia concerns settled in the locality and important developments in the industry took place within the next forty years. In 1850 four important britannia companies which were flourishing there, were combined as the Meriden Britannia Company, which was, as we shall see later, in turn absorbed by the International Silver Company.

Meanwhile, what was known as "cheap silver" had been developed—that is, various processes of making silver amalgam and silver plate. In 1742 in Sheffield, England, a method of combining copper with silver in layers had been successful and the result was called "Sheffield Plate." This process consisted of applying a thin layer of silver to one of copper and was the accepted form of silver plate until the discovery of electroplating, a century later.

Here enters the famous trade-mark "1847 Rogers Brothers." This process was perfected in 1847 by three brothers—Asa H., Simeon S., and Wm. Rogers, silversmiths in Hartford. It is characteristic of the development of Connecticut industry that the great silver-

plating business of the State began in a small cellar. The method consisted of plating by means of an electric current, which separated the pure silver from a bar in the chemical bath and caused it to adhere to the articles to be plated. The ware was named by the brothers for the year in which it was discovered and the trade-mark, has been retained to the present time, and may be found in the advertising columns of any magazine. The business grew. The steel "blanks" to be plated were manufactured by the Norwich Cutlery Company, in which the brothers were interested. One of them, William, withdrew from the Hartford company and formed with his nephew the Wm. Rogers Manufacturing Company, but later the firms again combined, continuing to manufacture under the trade-mark "Rogers & Bro. A I," until sold to the Meriden Britannia Company.

Another old Hartford County silver company is The Williams Brothers Manufacturing Company, of Glastonbury, makers of silver-plated and nickel-silver flatware. The company was started by Frederick Curtis in 1834 in East Hartford, and somewhat later moved to what is now Glastonbury to secure a water privilege, the name becoming Curtisville Manufacturing Company. With the Civil War, however, the entire plant was conveyed to the Connecticut Arms Company, which enlarged and changed it to manufacture a certain type of revolver. Owing to patent infringements and litigation, financial difficulties overtook the company and the plant finally found its way to the American Sterling Company, and drifted back to its original purpose. Again financial troubles forced a sale, this time to the present owners, Glastonbury and Hartford interests for the most part, lead by J. B. Williams & Company, which owned other

manufacturing plants in the town. They are makers of fine flatware only.

At the same time another development was taking place which reveals that what is often termed luck may be merely acute observation and alert seizure of opportunity. Robert Wallace, who was making britannia and pewter spoons in an old grist mill in Cheshire, chanced to be shown by a New Haven patron a spoon made of a metal new to both of them. Dr. Feuchtwanger, an analytical chemist, was known to have brought a small bar of the metal from Germany. Wallace succeeded in purchasing the bar, and, carrying it to Waterbury, had it rolled and from the sheet made four dozen spoons. While in Waterbury he met an Englishman who possessed the formula for the new metal, and this, too, he purchased for $25. It proved to be an alloy of nickel, zinc, and copper, in the proportion of about two of copper to one of each of the other metals.

Small quantities of the necessary metals were secured and fused, and the product sent to Waterbury to be rolled. The result was the successful "German Silver." The new metal was harder and more durable than pewter or britannia, was not expensive, had the appearance and texture of silver, and, most important, was well adapted for rolling. Neither britannia nor pewter could be rolled, and hence had to be cast. With the adoption of German silver in their place, goods could be made cheaply and rapidly in quantity.

The metal was first used by its finder, Roger Wallace. Encouraged by its success, he moved to a factory in Wallingford and there began the manufacture of flatware on an extensive scale. The resulting firm, R. Wallace & Sons, has remained in the hands of the

family, having at present an annual volume of business of $4,000,000 to $5,000,000 and 1200 employees. It sells flatware all over the world. During the Great War it made practically all of the spoons and forks used in the United States Army, having supplied 16,000,000 tinned spoons and forks. It also supplied spoons and forks to others of the Allied nations. Toward the latter part of the war it manufactured a special type of gas mask for the government and certain surgical instruments for the medical corps. The trade-mark "1835 R. Wallace" is not as well known as that of some of the other silver products dating from the same period, because until nearly 1900 the company sold its product to other concerns and did not stamp goods with its own name. It is, nevertheless, one of the largest and oldest silver concerns in the State, the entire industry being under obligation to them for the adaptation of German silver to the trade.

In 1853 the Bristol Brass Company, recently established, began to supply metal for the silver industry to Holmes & Tuttle of that city, who had started the manufacture of nickel silver flatware. This young company was hit by the panic of 1857 and, as it was indebted to the Bristol Brass Company for a large sum, arranged to be taken over by them in payment of this obligation. Thereafter it was run until 1901 continuously as the silver department of the Bristol Brass Company. It was then incorporated as the American Silver Company, and in 1914 was set off as a separate company with a paid-up capital of $400,000. Its annual production is nearly $1,000,000, marketed in the United States and exported to Canada, Mexico, Porto Rico, Cuba, and

South America. It furnished table cutlery for the army during the World War.

About 1860 The Scovill Manufacturing Company of Waterbury also took up the manufacture of German silverware, and plated copper with gold, silver and platinum by a special process invented by a Frenchman, Eugene Martin, who entered the employ of the company at about that time. At this same period, as is elsewhere told, they also had a large and lucrative business making silver-plated copper plates for daguerreotypes.

Manning, Bowman & Company, organized before the Civil War by Thaddeus Manning, originally made tin tea and coffee pots with handles, spouts and covers of the better patterns of britannia, and bottoms of copper or iron. As the first factory was in West Cromwell, which is adjacent to Berlin, this company at first was grouped with the tin industry of that town; but later it was incorporated as Manning, Bowman & Company, and moved to Middletown and thence to Meriden. It then began to take up the Meriden products and made "White Metal," a britannia, introduced to the company by an English superintendent, Edward Furniss, a native of Sheffield. About 1870 silver-plated ware, and a little later nickel plating, was added, the latter being for many years their chief product. Of recent years the company has made electrical household appliances and household and dining room appointments of nickel plate, silver plate, copper and aluminum, and also vacuum bottles of various sorts. During the war the company contracted to make over 7,000,000 pieces for the government, mostly mark 5 adapters, booster casings, fuse bushings, sockets and socket holders, used in connection with the 75 m. m. high ex-

plosive shells. It is believed that Manning, Bowman & Company was the only source of supply for the mark 5. These articles were entirely foreign to the regular output, requiring new equipment, machinery, and annealing ovens. In addition nearly 4,000,000 trench mirrors, eye pieces, and rings for gas masks were made.

In New Haven and Hartford Counties there are nearly fifty factories engaged in the silver, silver plating, and allied industries, mostly located in Meriden and Wallingford, where the industry originally localized. In the same cities, too, has grown up along with the silver industry, the manufacture of jewelry, cut glass, lamps, decorated china and other useful and ornamental domestic furnishings.

The story of the final development of the industry during the modern period of quantity production, combination and re-combination is graphically told by the history of the International Silver Company, the great merger formed in 1898 of most of the existing silver companies, old and new. As has been noted, the beginnings of this combination were in 1852 when the several britannia plants in Meriden were combined under the name of the Meriden Britannia Company. This combination was the conception of Horace C. Wilcox and it was largely due to his initiative and organizing ability that both this and the subsequent great organization were developed. Horace C. Wilcox and his brother, Dennis, together with J. D. Frary, I. C. Lewis and W. W. Lyman formed the company with a capital of $50,000, Frary later withdrawing to form in New Britain, with others, the firm of Landers, Frary & Clark. The Britannia Company, realizing the potential advantages to their concern of the silver-plating process,

devised by the Rogers Brothers in Hartford, who were in need of capital, in 1867 purchased a part of the Rogers interests, advertising its goods in the catalogue of that year as supplying "all the advantages of silver in durability at 1/5 the cost." Branches were opened as the nation developed. A salesman of the company still living, remembers when Minneapolis seemed literally a "jumping-off place." In 1867 a branch was opened in San Francisco to capture the trade west of the Rockies; 1878 saw a branch in Chicago; 1869, in New York. In those days, when the great transcontinental railroads were not realities, and merchandising was still on a basis not far removed from that of the historic tin peddlers, the earliest wares were sold, like theirs, in specially equipped wagons, other commodities being frequently accepted "in trade." In 1869 the Rogers, Smith & Company, founded by another of the three Hartford brothers, was likewise absorbed. Some years later Wilcox & Evertsen, a New York concern, was acquired.

The wide prevalence of the name "Rogers" in the silver industry, confusing at times, is due to the efforts of various silver companies to secure the services of one or another of these gifted brothers. All the rivals for the acquisition of their abilities are now in the fold of the International Silver Company, which uses all their trade-marks. To those already listed should be added Rogers & Brothers, organized in 1858 in Waterbury, makers of "The Olive," the first fancy pattern in electro-plated ware in America; the Rogers & Hamilton Company, established in 1886; and the William Rogers Manufacturing Company, Hartford, 1865. Besides the Meriden Britannia Company and the Rogers group,

there also were acquired, in the process of the combination of 1898, the Simpson, Hall, Miller & Company, organized in Wallingford 1866; the Simpson Nickel Company, 1871, who for years supplied the nickel blanks for the former Simpson Plating Company; the Wilcox Silver Plate Company, (originally Wilcox Britannia Company) 1865, including the Parker & Casper Company, which it had bought out; the Meriden Cut Glass Company, 1870, an offshoot of the Meriden Silver Plate Company, engaged in making silver-mounted cut glass dishes; the Barbour Silver Company, Hartford, 1892, a union of three silver companies of that city; the Derby Silver Company, 1873; the Watrous Manufacturing Company, 1896; the Holmes & Edwards Silver Company, of Bridgeport, 1880, whose name is a well-known trade-mark for silver inlaid ware; the Norwich Cutlery Company, Norwich, 1889; and the Middletown Plate Company, Middletown, 1864.

This high type of modern industrial development was capitalized for $20,000,000, with headquarters at Meriden. Within the next few years the United States Silver Corporation was acquired, giving the International Silver ownership of C. Rogers & Brothers of Meriden. Later, in order to serve and protect its Canadian business, the company acquired a controlling interest in the Meriden Britannia Company, Limited, of Hamilton, Ontario; the Standard Silver Company, Limited, of Toronto, Ontario; and the William Rogers Manufacturing Company, Limited, of Niagara Falls.

The contrast between modern quantity production as conducted on a huge scale in such plants as those owned by the International Silver Company and the making of those pieces of silverware for our colonial ancestors

which are now so highly prized is striking. As an object lesson in what Connecticut genius has produced in this single art, it may not be out of place to describe briefly some of the steps of modern processes. In place of the individual silversmith, who hammered his white metal upon anvils, applied his planishing hammers, stopped from time to time to anneal the piece and finally applied his rotten stone and burnishers, we now have the modern factory, in which division of labor is perfected to a high degree and one process succeeds another with rare precision and speed.

The biography of an ordinary tablespoon, from the moment when the blank in its first rude state is cut from the sheet of nickel silver until it reposes a completed utensil in a velvet box upon the show-case, tells an illuminating tale of present-day factory achievement. From a sheet of nickel silver is cut a blank, which bears small resemblance to a spoon, being about half the length of the finished article and very much wider. The blank is then "squeezed," which gives to the part that is to become the handle a little more of the appearance that it will later assume. This squeezed blank is then passed through a series of steel rolls, giving length to the handle and width to the bowl, and distributing the metal according to the correct thickness—that is, the bowl will be thin, and the shank thick. The next process is termed "clipping," the spoon being cut from the blank in the correct outline of the pattern. But the process of rolling the metal has so compressed it that it is necessary that the article be annealed—that is, the shaped blanks are placed in an oven and brought to a red heat, which renders them malleable. The pattern may then be stamped upon the handle and the bowl shaped, usually

leaving a small burr where the metal has oozed out between the dies, which has to be removed by trimming. The handle is now ready for the stamping of the trade-mark. This is followed by various operations of polishing until a high finish is developed.

The article is now ready for the plating room, which is a large clean department lighted from overhead and containing rows upon rows of tanks filled with a beautiful clear amber solution in which the articles to be plated are suspended. This room must be scrupulously clean, as silver is a curiously capricious metal, and permits of no untidiness. Many of the solutions in the tanks have been in use for years. The more they are used the better the solutions behave, and, if allowed to remain idle for even a few days, trouble would be likely to result.

Electricity does its work after this manner. The articles to be plated are suspended in a frame in the silver solution. This frame is connected with the negative pole of a magneto-electro machine, while the silver is suspended in the solution from bars and connected with the positive or opposite pole of the machine, thereby forming a circuit for the electricity through the solution. The amount of silver deposited is regulated automatically, an alarm warning the workman that the articles have received the proper weight of silver. When the ware is removed from the bath, it is snow white. It is then brightly burnished, or given a soft finish as may be preferred. The thickness of the silver deposited, however, is not the only requisite to insure quality. The plating must be hard as well as thick. This is accomplished by means of burnishing, after the article is plated and before it receives its final buffed finish. When the article comes out of the plating bath, the silver deposited

is in a comparatively porous and "fluffy" state. The buffing will hit the high spots, but burnishing turns the minute edges, closes the pores and makes the silver hard and compact, vastly increasing the wearing quality.

By such processes as these, which in varying forms may be duplicated in any modern plant, has industry ministered to the comforts and amenities of life! The Aladdin's Lamp of present day business organization and engineering skill has literally converted the poor man's hovel into the Prince's palace; for it is a veritable fact that the home of the average skilled workman now possesses conveniences, comforts and luxuries which were unknown to the nobility of a century ago. This is the gift of the factory methods and quantity production to which Connecticut has contributed so prodigally.

ARMS AND MUNITIONS

CONNECTICUT has always been an arsenal State. From the time before the Revolution when cannon were cast in Litchfield County for the British government, to the recent days of the World War, when an incalculable volume of war material was turned out in the great hardware and munition factories of its industrial centers, Connecticut has been famous for its arms.

In the darkest days of the Revolution, Washington's staff gratefully bestowed upon Connecticut the title of "The Provision State," because of its fidelity and efficiency in furnishing supplies to the patriot army. In foreign wars it has indeed furnished munitions to each contender. "There have been times," says Scudder, "when contending armies have both been armed from the little State of Connecticut, and yet the State itself has furnished (since 1800) hardly a particle of raw material, its entire contribution being the ingenuity of its workmen and the mechanical genius of its inventors."

For the nearly three years that elapsed before an aroused public conscience and the impact of events forced a hesitant Federal Government to bear a man's part on the recent world crisis, Connecticut had been in the vanguard of the struggle by furnishing the allies—at a handsome profit, it is true—a measurable share of the means for carrying on. Modern wars are not contests between army and army, but between one national organism or a group of organisms and another, and in the long run the group with the largest reserve of technical skill, amassed capital and public morale is bound to prevail. Thus it came about that the firm foundations laid by the Whitneys, Corbins, Chases, Colts,

Sharps, Parkers, and Spencers of an earlier day furnished the rifles, machine guns, aircraft guns, shrapnel and small munitions that threw a decisive weight upon the trembling scales at a fateful hour in the history of mankind.

The making of munitions presents another aspect in which the general conditions of pioneer life shaped the bent of the people. Where shooting game was a necessary preliminary to eating meat, and guns were stacked in the churchyard for instant defense against a savage foe while the people piously listened to long sermons, the production of munitions was natural. The casting of cannon and balls was, therefore, by no means confined to Connecticut. As early as 1864 the industry was carried on in Massachusetts, and by the time of the Revolution it had spread to some extent into Rhode Island, New Jersey, Pennsylvania and Maryland. The rare toughness of the famous Salisbury iron, which has been repeatedly referred to, gave Connecticut a peculiar advantage in this direction. The modern pacifist may well bear in mind that the Connecticut of today might never have existed had not his forebears been vigilant in the defense and swift in the attack. The Indian raids, the Pequot wars, the menace of the Dutch along the Sound, and the exhausting French and Indian wars, by virtue of which America, as John Fiske points out, became an exponent of the English system of government rather than that inherited from the Roman Empire, were all necessary measures in the founding of the Commonwealth. So, too, was it necessary to protect the shipping trade. In those valiant days no merchant man sailed unprotected.

The force of circumstances continued to operate for

the development of the firearms industry throughout the nineteenth century. Not only was there constant warfare abroad, but the United States, too, needed arms for her own five wars during that century. The bold pioneers who pushed the boundaries of the nation from a fringe along the Atlantic coast to the present dimensions of a half-continent, also had to be equipped for fighting human and brute foes and providing meat and game for sustenance.

Until the transfer of British patronage to Swedish iron, the Litchfield County munition industry prospered. In the blast furnace erected in 1762 by John Haseltine, Samuel Forbes and Ethan Allen, chains, cannons, and anchors, notably the anchor of the "Constitution," were cast; so also were the guns on the Battery at New York. In 1770 the furnace passed to the hands of Richard Smith of Hartford, a Royalist, and apparently from that time to the Revolution he was casting shot and shell there for His Majesty's troops. On the outbreak of the hostilities, Smith went to England and the Governor, although he did not confiscate the property, took over the works, manned it with sixty workmen, and placed it under John Jay and Gouverneur Morris, Agents of Congress, who came frequently to oversee the casting and proof of the cannon. The cannon cast from Salisbury iron were from 4 to 32 pounders, tested under the eyes of the agents, Hamilton and Trumbull. Considerable shot and shell and material was also supplied to the Springfield Arsenal. Waterbury, too, had its part in the work. Although the metal industry was then in its infancy, Bronson's "History of Waterbury" says that Lt. Ard Welton made small arms by hand during the Revolution, and Bishop (1865) naively adds that "this

was the commencement of the manufacturing business of that busy town."

Windham County was also famous for its warlike spirit. When the Port of Boston was closed, Windham's instant offering of a flock of 258 sheep was the first aid received by the distressed city. Powder was made for the Continental forces in the mills of Gray and Elderkin in Willimantic, and Huntington made, it is claimed, the first gun turned out of an American workshop. He also repaired the wretched firearms carried by the private soldiers.

In 1774, seeing that the war was imminent, the royal government had prohibited the exportation to the Colonies of powder and its constituents, and in consequence the several powder mills in the Colonies, especially in Massachusetts, were abandoned. But the Continental Congress and various Committees of Public Safety instantly took every means of encouraging their re-establishment, particularly as the workmen still resided in the vicinity. In 1775 a powder mill was built in East Hartford, by William and George Pitkin, the same family which made one of the earliest American watches.

Considering the Parliamentary restraints that had been in force, it is amazing that the Continental forces were able to arm themselves even as adequately as they did. The story is told of a British officer asking a captured American in surprise "Where do you get all your guns?" "We make them," was the reply. "But where did you get your patterns?" "At Saratoga," was the laconic response. In Connecticut, state bounties were offered for the manufacture of arms, together with an offer to purchase all that could be made to the number of 3,000.

The inevitable impetus to the manufacture of Connecticut munitions given by the Revolutionary War did not die with peace. This is due in great measure to that son of Connecticut whose mechanical and organizing genius compels repeated recognition in this volume. Eli Whitney, defrauded of his reward for inventing the cotton gin—perhaps the most valuable single American contribution of that century of epoch-making inventions—finally abandoned hope. Definitely putting the cotton gin episode out of his mind, he turned to the making of munitions in New Haven for a livelihood. It is some satisfaction to realize that the fortune of which he was defrauded by the loss of the cotton gin was later amassed by him in the manufacture of arms. In 1798 he received a contract for 10,000 stands of muskets. The terms of the contract are interesting. He gave his bond for $30,000 and was to receive $13.40 for each musket. Work was started near East Rock in New Haven. The contracts were repeated through successive administrations and the undertaking prospered year by year. The inventive genius which conceived the cotton gin and the mechanical ability which created it were applied so successfully that Whitney left behind him another heritage, less recognized than the gin but equally valuable. This was the establishment of the modern Industrial System—specialization of labor and standardization of parts to bring about quantity production—whose revolutionary results have been discussed in the chapter entitled "The Period of Transition." His tools and machinery were adopted by other manufacturers throughout the country, particularly, of course, in the iron and steel works. Gallatin's Report for 1810, in mentioning the production of arms in the coun-

try, speaks of the number of factories, "of which the most perfect is that near New Haven."

Meanwhile the munition industry was progressing elsewhere in the State. In 1810 Oliver Bidwell of Middletown was manufacturing firearms. About 1826, in the same town, Nathan Starr was making swords considered equal in temper to the famous blades of Damascus. Swords of his workmanship were presented to General Gaines, General Johnson and Commodore Hill.

Another of the early carftsmen, Simeon North of Berlin, the first official pistol-maker in the United States, is well known, since many of his pistols are now the chief treasures of collectors. In 1913 two of his descendants published a Memorial entitled "Simeon North, First Official Pistol Maker of the United States," containing an excellent account of his work, and of the "Spruce Brook Industry," as his plant was called. His old account books are still preserved, and as early as 1808 are entries showing the manufacture of "2,000 naval pistols," and later "6,000 pistols." In 1813 a government contract for 500 horse pistols is noted. These books reveal an interesting contrast with the modern method, which was being developed at the same period by Eli Whitney less than thirty miles away. North built up a system of carefully trained apprentices, who worked with craftsman's pride over each pistol turned out. The books are also of interest in showing the wages of the period, recording that one Joseph Henerson agreed to "blow and strike welding pistols at $12 a month." This was evidently a high wage, for another workman is recorded as having been employed for three months at $6 a month and another for three months

at $8 per month. At the close of the War of 1812 Simeon North was commissioned by the State to make two pair of gold mounted pistols as testimonials to Captain Isaac Hull of the Frigate "Constitution" and Commodore McDonough, who captured the British Squadron. So great was his pride in this commission that he sent to England for a special artisan to aid in making the weapons. They were presented as planned. Those assigned to Commodore McDonough now lie in the Wadsworth Atheneum at Hartford, and those to Captain Hull are kept as a memento in the office of the Secretary of the Navy at Washington.

Another great munitions industry in Connecticut was the Sharps' Company, pioneer producers of breech-loading rifles, with extensive factories in Hartford and Bridgeport. This was the invention of Samuel Sharps, and the industry was established in 1851. John C. Palmer was the first president of the Sharps' Company. Within a few years it was employing 450 men and producing 30,000 rifles annually. For many years it rivalled in importance in the munitions world the famous Colt's Armory. The importance of this rifle in superceding the old muzzle-loading weapons is difficult for the modern mind to comprehend. Their first general use in the Civil War was of incalculable service. Bishop, author of the "History of American Manufacturers," published in 1864, himself a soldier, devotes an enthusiastic paragraph to this subject. "At Yorktown," he says, "a single man with a breech-loading rifle kept a 100 pounder gun silent for days—at Pine Bluff, in Arkansas, 550 men, armed with Sharp's rifles, defeated and actually drove away 4,000 under Marmaduke, though the latter had the advantage of being pro-

vided with artillery. The preservation of General McClellan's army in his seven days' retreat is said to have been due mainly to a Connecticut regiment, armed with these rifles, coming forward in a critical occasion; and the wonderful victory at Mission Ridge near Chattanooga, to the fact that a portion of the Federal forces engaged were armed with Spencer's breech-loading and repeating rifles; 'Who,' said a prisoner, 'could withstand men that kept shooting and never loaded.' Major General Rosecrans has stated (November 13, 1863) that he had no doubt that, could such arms of proper construction be substituted at once for those now in use, it would add not less than 50 per cent to the force or power of the troops now in the field, or in other words we should augment our army one-half by changing the weapons."

The manufacture of gunpowder has been led by the great Dupont de Nemours Company of Delaware, since its establishment soon after the Revolution. By 1810 it had Connecticut powder mills in its organization. This famous powder was celebrated from the first for its excellent quality. It was sold in packages impressed with the figure of an eagle; hence the lines—

> From foaming Brandywine's rough shores it came,
> To sportsmen dear its merits and its name.
> Dupont's best Eagle, matchless for its power,
> Strong, swift and fatal as the bird it bore.

The Hazard Powder Company at Hazardville was put in operation by the Dupont Company in 1811 and grew rapidly. During the munitions boom of the Civil War, the company had near Hartford and at Canton 18 sets of rolling mills, 7 granulating mills, 5 screw press buildings and 3 hydraulic presses of 500 tons each; as

Col. Samuel Colt—By Charles L. Elliott

well as about fifty other buildings for mixing, drying, glazing, dusting, assorting and packing, with salt petre refineries, machine shops and magazines. In all there were about 125 buildings at Hazardville. The larger buildings were named for engagements in the Civil War, such as "Harpers Ferry," "Bull Run," and "Fortress Monroe." The annual product exceeded $1,000,-000 in value. During the Crimean War they also supplied the British Government with 10,000 barrels of powder.

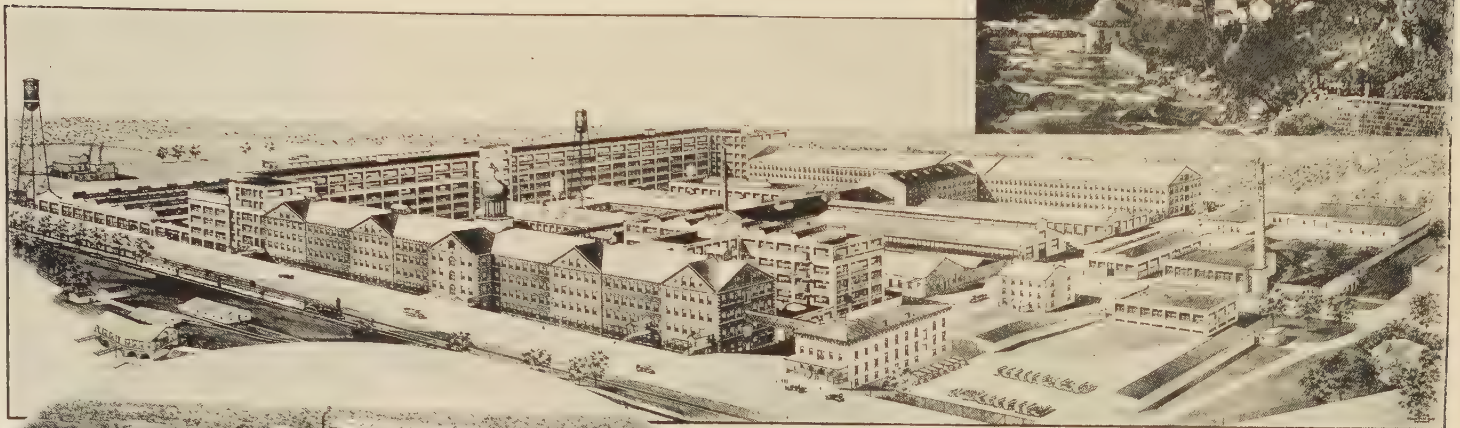
Another development which has contributed essentially to the development of the firearms industry was the invention in 1807 of the percussion system. This simple device, by which, through the impact of a falling hammer or other similar mechanism, a small particle of chemical called the "primer" explodes and in turn ignites the powder, supplied a valuable factor in the industry. Like many other inventions, its very familiarity has led us to forget its importance. From this a transition to the cartridge was easy and natural. Ethan Allen, who had transferred his arms manufacturing industry to Worcester, Massachusetts, made various improvements and inventions, notably the breech-loading Allen sport rifle, for the use of metallic cartridges. Cartridges thus constructed were invented in France in 1831 and introduced into this country shortly afterwards, paper cartridges having been employed up to that time. A further indispensible condition of the production of the modern firearm is extreme lightness of material combined with a high degree of strength. To this Horatio Ames of Falls Village, in 1854, made an important contribution when he succeeded in producing a "wrought iron gun stated to surpass all other guns of

equal weight in its power to sustain heavy charges with no danger of explosion."

The "Colt six-shooter" is associated in every mind with romance and adventure, and it is fitting that it should have originated under corresponding conditions. In 1830 Samuel Colt, then barely 16 years old, a native of Hartford and grandson of John Caldwell, President of the Hartford Bank, ran away to sea on the good ship "Corlo," out of Boston for Calcutta. During the long tropic days the young runaway, inspired perhaps by gun play on board as well as his native inventive genius, carved out of wood with his jacknife the model for the first six-shooter—the very model which is now a treasured relic at the great Colt plant in Hartford. This was a cumbersome thing, the six shots being dependent upon six barrels which revolved. After his return to this country, he had a somewhat checkered career for a few years, one episode of which was to tour the country with "laughing gas" as Dr. Coult; but in 1835 he went abroad to secure patents on his repeating firearms model. The next year he secured them in the United States, and, a company having been formed, he began to manufacture at Paterson, New Jersey, carbines and pistols to the value of $300,000. But the company failed in 1842. Contemporary accounts blame the failure of the early model, to its cumbersome style, but later authorities to the refusal of the United States Government to adopt the "Colt." It had, however, developed two interesting pistols. The first, known as the "Texas," was a 34 calibre with a concealed trigger, which weighed about two pounds and seven ounces. Later the "Walker," named for a famous Texas ranger, was evolved. It was a 44 calibre arm,

DEVELOPMENT OF THE COLT PLANT

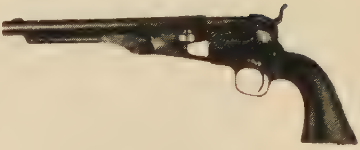
The first Colt factory, Paterson, N. J., 1836



The Colt plant as it is today

Colt plant at Hartford, 1914, at beginning of the "World War"

The original "Colt"



Type of Colt used in the Civil War

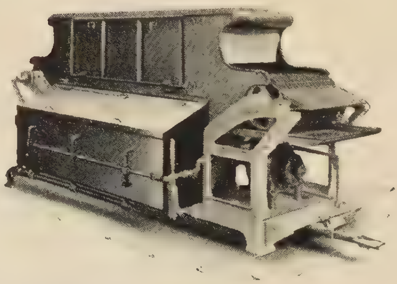
The "Cowboy's Friend"

A modern "Colt"

Government model caliber .45. The type of "Automatic" used in the World War.

Colt-Browning automatic machine rifle (a World War evolution) adopted by U. S. government.

Colt-Browning automatic machine gun (adopted by U. S. government.)



Colt "Autosan" dish washing machine

considerably heavier than a "Texas," provided with a lever for ramming the bullets into the chambers of the cylinder. It was successfully used in the Seminole War. Another model was similar to the "Walker," but of 47 calibre and was so popular that $100 was sometimes paid to procure one.

In 1847, at the outbreak of the Mexican War, Colt received a contract for 1000 revolvers through General Zachary Taylor, who had been impressed with the Colt revolvers in the Seminole War and the battles for Texan independence. Taylor, who was preparing the troops for war, signed the contract himself for the revolvers at $24 each. They were made in a small armory near New Haven rented from the Whitney Arms Company. These arms were provided with an extension stock, which enabled them to be used as carbines, and the stock was hollow and also served as a canteen. Their success was so marked that in 1855 the Colt's Patent Fire Arms Manufacturing Company was chartered. Two hundred and fifty acres of land on the banks of the Connecticut River at Hartford were purchased and a factory erected just in time to ride to prosperity on the waves of the demand provided by the Mexican War, the gold craze, the foreign demand and finally the Civil War.

Within six years the company was turning out 70,000 revolvers a year. Great Britain and Russia sent for Colonel Colt, and at Enfield, England, and Tulsa, Russia, armories were built for the manufacture of his revolvers on a large scale. These weapons were used in the Crimean War by the English and by Garibaldi in Italy. During the Civil War 300,000 were used, and the company, in addition, was producing great

numbers of muskets. New factories had been built and, although the inventor died in 1862 before this great expansion, Whitney's lesson of interchangeability of parts and careful assembly had been learned and a rigid inspection system kept up production. The efficiency of this six-shooter, even then unknown in many parts of the country, in the Civil War is a matter of history. During that war types of arms "went in muzzle-loading and single-fire, and came out breech-loading repeaters." In every war since 1836 Colts have played a part, and since 1847 they have been the official side-arms of the Army, Navy and Marine Corps of the United States.

Colonel Colt was succeeded in the Presidency by Elisha K. Root who, even at that time, was described as "one of the most accomplished mechanics of the age." He invented many important machines, chief among which is the "drop forge," now a valuable common-place of manufacture. The Colt Patent Fire Arms Manufacturing Company has always diversified its product, having made at different times, in addition to arms, sewing machines, lawn mowers, stock indicators, adding machines, Baxters' steam engines, dish and silver cleaning machines, and machines to wash parts during the manufacturing processes. In 1922 the company purchased the Johns-Pratt Company of Hartford, makers of an asbestos packing for air pumps, steam valves, etc., and the plant is operated as a Division of the Colt Patent Fire Arms Manufacturing Company.

Another product of the Colt Company should have special mention—the Gatling Gun—which was the first practically efficient machine gun. This rapid fire gun was invented by R. J. Gatling, a physician in Indian-

apolis, in 1862, and was fired in that city in the same year, discharging 200 shots a minute. After the Civil War, Gatling Guns began to be made at the Colt factory where machinery was set up to turn them out in quantity and perfection. It consisted of a series of barrels, in combination with a grooved carrier and lock-cylinder. It was loaded at the extreme rear, the cartridges being fed to the gun from feed-cases, was supported on a gun carriage, and presented the same general appearance as its descendants during the Great War, when machine guns played so vital a part and reached such a degree of perfection.

Another name and industry, while of New York origin, has become so intimately associated with Connecticut as to warrant a prominent place in this chapter. That is the name of "Remington." The origin of the Remington Arms Company, too, lies in a boyhood ambition. The tradition runs, that in 1816 Eliphalet Remington and his son were working together at their forge in Ilion Gorge, New York when the lad asked his father for money for a rifle, and was met with refusal, like many another boy with a similar request. But young Remington knew his forge, and, if he could not buy a rifle, he determined to make one. Having collected scrap-iron, he welded a gun barrel and walked fifteen miles to Utica to have it rifled. He turned out such a good weapon that soon the neighbors engaged him to make similar guns for them, and the Remington forge found time for little else but gun-welding. Several times a week young Remington packed a load of gun barrels on his back and tramped to Utica where a gunsmith rifled and finished them, for at this early date most gun barrels were imported and thereafter finished by local

gunsmiths. Tiring of these trips, the young manufacturer devised a machine of his own for rifling and thus the little forge blossomed into a gun factory, receiving scrap iron from the neighborhood and turning out finished rifles and shotguns. The young inventor knew how to utilize nature, and a nearby ledge of red sandstone was soon furnishing grindstones for reducing the barrels to proper form, and a convenient brook was furnishing power. In 1828 the little forge was abandoned for a factory near the Erie Canal where now the original plant of the Remington Arms Company stands, ancestor of the great plants located in Bridgeport today. The wars here and abroad and the arming of pioneers expanded this factory, as they did the Colt concern. During the Mexican War they had a government contract for carbines, and with the oncoming of the Civil War they received further contracts—"Harpers Ferry" muskets, Maynard self-priming musket locks, and Remington revolvers under the Beal patent being made in quantities. Eliphalet Remington took his three sons into partnership; and the little factory at the corner became a great industry surrounded by an industrial town.

The Civil War had shown that breech-loading had forever supplanted muzzle-loading, and an inventive genius, John Rider, was engaged to develop the new arm, surrounded by the best skilled mechanics obtainable. At this time, as during its entire subsequent career, the company has made many important improvements in rifle making. These improvements, notably the system of a dropping breech-block backed up by the hammer, brought in orders from abroad. First Denmark ordered 42,000; in 1867 the United States Navy adopted

the Remington breech loads; then followed Spain, Sweden, and Egypt. In 1870 France called for a capacity output. Many are the anecdotes of this great exporting period—how the Khedive of Egypt was so pleased with the arms that he presented Samuel Remington with a marble palace near Cairo; how an agent disguised in Chinese costume made his way to Pekin and secured an audience with Li Hung Chang, who ordered enough rifles to bring the total sales to the million mark.

Less romantic, but far more important to the future of the concern, was the sale to Hartley & Graham, a New York sporting goods house, of 144,000 of these rifles. It was through this connection that, when a falling off of orders occurred about 1885 and other enterprises undertaken by the parent company, such as the Agricultural Works, the Scattergood Cotton Gin, and the Sewing Machine—which alone sunk a million dollars—brought about a failure of the concern, it was bought by this same firm of Hartley & Graham. The purchasers had meanwhile become the Union Metallic Cartridge Company, and this brings the story to Connecticut. It was during this period of struggle that the Remington Company also sold its typewriter.

About 1845 Marcellus Hartley, became clerk in a hardware and sporting goods company in New York, Francis Tomes & Sons, where he was placed in the gun department. His interest in guns increasing, he was sent as their gun salesman to the West and South, and in 1854 he formed, with J. Rutledge Schuyler and Malcolm Graham, a new firm of Schuyler, Hartley & Graham. This firm, in spite of the panic of 1857, prospered, and like the rest boomed with the Civil War. During the

War, Hartley was sent to England with the rank of Brigadier General to buy arms, a mission requiring tact as well as knowledge, since the wide-spread partisanship for the Confederacy hampered him at every turn. He had to create sympathy with the North, outwit the purchasing agents from the South and break the "corners" on guns formed by English manufacturers. He distributed 15,000 copies of John Brights' anti-slavery speech in Birmingham, and was able to secure about 200,000 rifles. After the war his career broadened into three main lines of development, one being his connection with the Remingtons, leading later to the acquisition of the plant; a second—and most important to us—being the formation of the Bridgeport Gun Implement Company to make rods, cleaners, extractors, etc., for the old style arms, and later other sporting articles when the breech-loaders displaced them; and the third being an experiment with dynamos and lamps with Hiram Percy Maxim—since famous as the inventor of the Maxim Silencer, but then known as an electrical expert—which laid the foundation of what is now the great Westinghouse Electric Company.

It was in connection with this that the great metallic cartridge industry grew up. While travelling in the West years before as salesman for Tomes & Company, Hartley was shown a roughly made metallic shell for the charging of a gun. He begged the shell as a souvenir and ten years later, realizing that metal cartridges were destined to displace paper cartridges, determined upon their manufacture. Several manufacturers had attempted it and failed and their plants and patents were for sale. These Hartley bought, and moved to Bridgeport, where he already had other in-

terests, incorporating in 1867 the Union Metallic Cartridge Company. Up to this time percussion caps, skin-cartridges for revolvers, linen cartridges for Sharps' breech loaders, and a few poor rim-fire copper cartridges had been made, but this new industry started at once to make metal cartridges successfully. The first cartridges consisted of the packing of powder, ball and wads into a single case so that the powder was ignited by a very small quantity of high explosive called "priming mixture." But the company soon evolved the improved center-fire type, generally used today. Much of the special machinery for the plant was invented by Alfred C. Hobbs, whose ingenuity was once displayed in a particularly interesting manner. The Bank of England offered a prize of $1,000 to anyone who could pick its lock. Hobbs, after working 51 hours, did it, and the lock now hangs in triumph on a wall of the New York office.

The Union Metallic Cartridges followed the world-wide career of the Colt Revolver and Remington Rifle. In the Franco-Prussian, Russo-Turkish, South American and other wars, "U.M.C." bullets were shot from Remington Rifles, often by both combatants. The same is true of the Spanish-American War. Of the many interesting anecdotes connected with the purchase and use of these war materials, perhaps the most dramatic is the escape of N. W. Reynolds, a "U.M.C." salesman, from Paris in a balloon in 1870, when the city was under German siege.

While the factory was filling a large contract for the Russian Army, General Gorloff, as inspector, spent several years at the plant, and his rigid inspection undoubtedly raised the standard of the product. A touch

of romance was added to his visit by the episode of a poorly clad Russian immigrant who applied for work at the Bridgeport factory and worked two or three months in a menial capacity. One morning he failed to appear as usual, but at ten o'clock arrived faultlessly attired, from silk hat to pointed boot, and said, with a courtly bow, "Good Morning, General." He was a nobleman's son who had been detailed to spy on Gorloff. At another time Gorloff rejected a large number of cartridges, to the great surprise of the officials of the company, who knew them to be perfect. Spain, then engaged with the Cuban Rebellion, at once bid in the rejected lot, and it was later discovered that this had been a secret plan for Russia to aid Spain in the emergency.

In 1873 the company bought out a Springfield concern engaged in making paper shells for shot guns by a tedious hand process, and in a short time were producing improved such shells by machinery. This kept up the output in peace time. After Hartley's purchase of a large interest in the bankrupt Remington Company in 1888, the guns continued to be made at Ilion and the ammunition in Bridgeport, the combined industry being known as the "Remington U.M.C." Among the Remington improvements and inventions in arms are the first bolt-action military rifles; first slide-action repeating rifles and shot guns; and the first auto-loading rifles and shot guns. Like the Colt Company and the original Remington Company, the Remington U.M.C. Company has diversified its product and is manufacturing at the present time a line of cutlery, including 700 varieties of knives. It now has about 6,000 employees in its various plants.

Another name, indigenous to Connecticut soil, whose mention summons before the mind the picturesque story of later American exploration, adventure and romance, is "Winchester." It runs through American fiction; it spells the story of western exploration; it summons up the trail of the Covered Wagon. When we hear it, we see cowboys on mustangs, hunters crouching behind boulders, pioneers fighting off Indian attacks and highwaymen holding up stage-coaches. Henry M. Stanley, on his first African search for Livingstone, carried a "Henry" rifle, progenitor of the "Winchester," and on later explorations and searches carried heavier models of the same weapon. Theodore Roosevelt, on his African trip and Perry and Whitney, on their explorations to the Arctic, also used "Winchester" products.

Although both concerns have, in a sense, competed in the same field, as a general rule the Winchesters have always been particularly popular with sporting men, explorers, border men and adventurers, whereas the Remingtons have sought an outlet for their product with the various governments of the world. The genealogy of this gun cannot be traced with the same distinctness as that of the Colt Revolver. As a matter of fact its beginnings were associated with a well-known weapon of a similar nature, the Smith & Wesson. The Smith & Wesson Company was engaged in its early career largely in retaining and perfecting various patents used during the time when the repeating firearm was being evolved.

In 1854 Courtlandt Palmer of New York and Horace Smith and Daniel B. Wesson of Norwich, Connecticut, members of the firm of Smith & Wesson, "formed a

limited partnership for the exclusive use and control of certain patent rights relating to cartridges and breech loading firearms which had been issued in 1849 and 1850." This partnership also acquired the patent issued in February, 1854 for a tubular magazine repeating firearm to Smith & Wesson, which was the basic patent for the "Volcanic Rifle" and the "Volcanic Pistol." The manufacturing of these arms was begun at once in Norwich, but within a few months the partnership sold part of its patents to the Volcanic Repeating Arms Company, which was incorporated at that time for the manufacture of arms and ammunition, especially the "Volcanics" under the Presidency of Oliver F. Winchester. It continued in business in Norwich for another six months when it was sold to Winchester and moved to New Haven, still under the original name. A contemporary authority (1864) speaks of the Norwich Arms Company as "one of the largest private armories in the United States, the early manufacturers of the breech loading rifle invented by Armstrong & Taylor, Kentucky."

Another few months, and the New Haven Arms Company was incorporated to take over and carry on the Volcanic business. Oliver F. Winchester was its President and B. Ryler Henry, an inventor engaged to perfect the "Volcanic Rifle," was superintendent. In 1860 the new model "Henry" rifle was developed. A few years later the company removed to Bridgeport, where another reorganization took place. A charter was granted to the Henry Repeating Arms Company, but before the change was effected the name "Winchester Repeating Arms Company" was settled upon. The business of the New Haven Arms Company was taken

over, the business moved back to New Haven, and the industry embarked upon its career. During all these changes of ownership, management and location, the "Henry" rifles were being produced and supplied to meet Northern requirements in the later Civil War years. Soon afterward there was manufactured what is claimed to have been the first really successful repeating rifle in the world—the "model 1866 Winchester." In 1868 the Winchester Repeating Arms Company acquired the property and patents of the Spencer Repeating Rifle Company, which had been its strongest competitor during the War; in 1869, the American Rifle Company (formerly the Fogerty Rifle Company); and in 1888, the Whitney Arms Company, Eli Whitney's historic company. Although during the Spanish-American War, the Winchester Company furnished cartridges, Lee navy rifles, Winchester rifles, model 1895, and large quantities of cannon-cases to the Government, their general reliance upon the sporting market has been observed.

Prior to the World War, Winchester manufactured only arms and ammunition, but since that time, having doubled their plant to supply the War emergency, they have been forced to seek uses for this increased plant on a peace basis. They, therefore, began to put out a line of hardware and sporting novelties—a great variety of products, which could be sold through the hardware trade by which the name was already so well known. At first the plan of operating their own retail stores was adopted in the leading cities of the country, but this project has apparently been abandoned. Their present product, besides arms and ammunition, includes a wide variety of builders' tools, chisels, hammers, files,

screw drivers, planes, saws, auger bits, axes, hatches, pliers, punches, wrenches, automobile tool kits, pocket knives, kitchen and table cutlery, razors, scissors, roller and ice skates, fishing rods, lines, bait, flies, reels, athletic equipment, flashlights and batteries and a line of paint and varnish. From this imposing list and the quantities in which the wares are being made, it would seem that the company is attaching an importance to hardware and sporting goods equal to that of guns. The present volume of Winchester business is $16,-000,000 annually, and the number of its employees 5400.

There is to be added a fourth name to the Connecticut group enjoying an international reputation in the highly technical field of the manufacture of rifles. That is "Marlin." It was in 1870 that John M. Marlin established in New Haven the Marlin Fire Arms Company. The firm was originally engaged in producing pistols, revolvers and the famous "Ballard" target and sporting rifles. The concern also manufactured hand-cuffs. As time went on, however, the manufacture of pistols, revolvers and hand-cuffs was dropped and the business centered around the production of repeating rifles and repeating shot-guns.

In 1889 Marlin brought out the first gun with solid-top, side-ejecting construction, which has since been followed by all other manufacturers of firearms in varying degrees in their recent models. Ten years later the Marlin company built the tools and manufactured the first of the "Savage" rifles, with which the Savage Arms Company started business.

In 1915, during the World War, the Marlin family sold the business to The Marlin-Rockwell Corporation, the plant and personnel were increased, and the fac-

tory converted into a machine-gun-making unit for the Russian and English governments. Later, they performed a like service for the United States government. The Marlin-Rockwell Company at the close of the war, in liquidating their various war products, decided to focus their activities upon the production of ball and roller bearing equipment and offered the business for sale. In 1921 it was purchased by a new concern formed under the corporate name of The Marlin Firearms Corporation. The old-time Marlin personnel was retained and the plant so operated until 1923, when, through a lack of adequate financial backing, the firm was forced into a receivership. Being thus placed on the market, it was purchased by an individual, Frank Kenna of New Haven, who, having faith in the rehabilitation of this established line of rifles and shot-guns, reorganized the business under the former name of The Marlin Firearms Company.

Under this management, the "Marlin" trade mark, familiar upon rifles and shot-guns throughout the world, had been revived. In the United States the product is marketed extensively through direct representation in the East, South and West, and through a sales agent on the Pacific Coast. A profitable business has also been developed in Australia and New Zealand. After passing through the adjustments and vicissitudes of the war and post-war periods, the prospect is bright that this distinctive product of Connecticut skill will reenter upon heritage which its past achievement deserves.

During the Civil War period, Middletown was a considerable munition center, the Alsop & Savage Firearms Manufacturing Company being a large manufac-

turing concern. In the same city Ira A. Johns manufactured gun locks, Peter H. Ashton barrels, and DeWitt Sage cartridges. Bishop in 1864 estimates annual production of arms in Middletown as $700,000—15,000 rifles for one company, 2,000 muskets for another company, 1,200 cast guns for another company. During the period of development, the Bacon Manufacturing Company of Norwich was also a sizeable concern engaged in this class of production, and that city can still lay two worthy claims to a place in the munitions group. These are furnished by the Davis Warner Arms Corporation, manufacturers of shot guns and pistols, which moved from Massachusetts to this state in 1917; and by one of the plants of the great Dupont de Nemours Company, which is employed for producing cartridges. Meriden also has an old and nationally-known manufacturer of arms, the Charles Parker Company, elsewhere referred to. Under the name of Parker Brothers there was developed the famous "Parker" double-barrelled shot-gun, which for decades has maintained a position of leading popularity among sportsmen and hunters of small game.

The Ensign Bickford Company of Simsbury is the original manufacturer of safety fuse in the United States and was founded nearly a century ago by the inventor of this device in England. Its story goes back to that important factor in Connecticut's industrial history, the old Granby or Simsbury copper mine, now called Newgate Prison. Miners' safety fuse was invented by William Bickford, in the mining district of Cornwall, England, in 1831. Within five years, the firm he had formed for the manufacture of his life-saving invention, Bickford, Smith & Davey, de-

sired to extend its rapidly increasing business to this country and made arrangements to this end with Richard Bacon, superintendent of the Phoenix Manufacturing Company at that time operating the copper mine in Granby. The branch company was called Bacon, Bickford & Company and its first factory was located at the mines. But the old copper mine had almost run its course and within a few years was abandoned. The fuse factory was thereupon moved first to East Weatogue and later to Simsbury. In 1839 Joseph Toy, an Englishman, came to Simsbury and rose rapidly in the company. On the withdrawal of Bacon from the firm, he became manager. The company was called Toy, Bickford & Company, and under his management and with the increase of mining in the United States, the manufacture grew and new buildings were erected. On Toy's death in 1887 his son-in-law, Ralph Hart, succeeded him and the present firm name was adopted. He continued the growth of the company and consolidated with the Climax Fuse Company of New York whose plant was located in Avon, near by, becoming president of the new corporation.

The English connections have been maintained with the original company carried on by Bickford, Smith & Company, Ltd., with established factories throughout Europe. Safety fuse, which has been the means of saving many lives in mines and wherever blasting is necessary, has been many times improved since Bickford's first invention. One of the most important types is "Cordeau," a detonating safety fuse consisting of a lead tube filled with trinitrotolene, the invention of a Frenchman. A year after its successful introduction into the United States in 1913, the Sims-

bury plant began its manufacture as "Cordeau-Bickford." It is used by quarries and mines for deep well holes, for blasts where many holes are to be shot at one time, and for subaqueous work. It is also used for testing the speed of explosives. This company has also furnished special fuse for many munition purposes. It also furnished the Government with many millions of feet of fuse for use in the construction of the Panama Canal. Its output is furnished to the coal fields, metal mines, and quarries in the United States and is also exported to the West Indies, Mexico, and South America.

A unique company, originally connected only with munitions but now more identified with the industrial machinery world, is the Maxim Silencer Company of Hartford, which succeeded the Maxim Silent Firearms Company, manufacturers of firearms silencers. In 1912 the new company added the manufacture of silencers for automobiles, motor boats, stationary and marine oil engines, air compressor and blower suctions and discharges and pneumatic machinery. In addition to its ability, so well known in detective fiction, to quiet the report of a gunshot, the Maxim Silencer is the only device available for large exhausts and suction noises, and is used particularly for both stationary and marine Diesel oil engines. Practically all shipping in which Diesel power is used for propulsion makes use of from one to six Maxim Silencers per ship, and all Standard Oil tankers are uniformly equipped with them. In addition to the silencers turned out at the home plant, certain manufacturers of marine hardware and automotive equipment have licenses to make them under the Maxim patents held by the company, its president being Hiram Percy Maxim, the inventor.

The interesting and internationally important subject of submarines falls more appropriately within this chapter than in any other. In it Connecticut has borne a characteristic part. It may not be well known that a practical submarine was invented by David Bushnell of Saybrook and was used successfully in the Revolutionary War. The account of this "curious device" from Bishop's History of American Manufactories (1864) is of interest for its detail and also for its mid-century attitude toward a type of craft which is now a familiar factor in warfare.

"About the same time (1775) this town gave rise to a novel and quite original specimen of naval architecture which is worthy of notice, rather on account of the ingenuity displayed by the inventor, than for the practicability or humanity of the design, although the principle may be one capable of useful application. This was the construction of a submarine vessel contrived by David Bushnell of Saybrook for the purpose of blowing up the enemy's shipping. Submarine inventions were not new, having employed the ingenuity of eminent mechanics previously, as they did Fulton at a later date. But the contrivance of Bushnell, of which the design was matured while a student of Yale College, and carried out immediately after his graduation in 1775, was essentially different, it is said, from any previous attempt. The structure, of which a detailed account may be found in the Transactions of the American Philosophical Society, and in 'Silliman's Journal' for 1820, is more briefly described as 'A machine for submarine navigation, altogether different from anything heretofore devised by the art of man.' This machine was so constructed that it could be rowed horizontally at any

given depth under water and could be raised or depressed at pleasure. To this machine, called "The American Turtle" (from its resemblance to two upper tortoise shells placed in contact) was attached a magazine of powder which was intended to be fastened under the bottom of a ship with a driving screw, in such a way that the same stroke which disengaged it from the machine should put the internal clockwork in motion. This being done, the ordinary operation of a gunlock at the distance of half an hour, or any determinate time, would cause the powder to explode and leave the effects to the common laws of nature. The simplicity of combination discovered in the mechanism of this wonderful machine has been acknowledged by those skilled in physics, and particularly hydraulics, to be no less ingenious than novel. Mr. Bushnell invented several other curious machines for the annoyance of the British shipping; but from accidents, not militating against the philosophical principles on which their success depended, they but partially succeeded.

"In 1777 Congress offered rewards for the destruction of British ships, and Bushnell made an attempt on the 'Cerberus' frigate, Commodore Simmons, at anchor off New London, in which he destroyed a vessel lying near her. About Christmas the same year, he sent a fleet of kegs down the Delaware to destroy the British ships which held possession of the river, and against which fire-ships had been used ineffectively. Owing to the darkness they were left at too great a distance from the shipping and were dispersed by the ice, but, during the following day, exploded and blew up a boat, occasioning no little alarm to the British seamen. The circumstances gave rise to the humorous song by the

Hon. Francis Hopkinson, entitled 'The Battle of the Kegs.'"

The distinction which Connecticut enjoyed as a pioneer in the field of successful submarines has been sustained during the early decades of the 20th century by the inventions and activities of Simon Lake of Milford, designer and builder of the internationally famous "Lake Torpedo boats." Jules Verne's familiar romance "Twenty Thousand Leagues under the Sea," furnished the young inventor his inspiration, and his studies and experiments bore fruit in the submission to the United States Government of his first plans for an under-water craft in 1893. Unsuccessful in securing their adoption, he built an experimental vessel, the "Argonaut Jr.," and in 1897, through the aid of private capital, launched the "Argonaut I," the first successful submarine to be operated by an internal combustion engine. The successful demonstration afforded by this craft resulted in the endorsement by the Naval Construction Board, of Lake's plans for an additional vessel, whereupon in 1901 the Lake Torpedo Boat Company of New Jersey was organized, and the "Protector" built at Bridgeport. Although endorsed by the Government Board and recommended by the Navy Department, the bill making an appropriation for its purchase was defeated in the lower House of Congress.

The recognition which the inventor failed to receive from his own country was speedily accorded by Russia during the Russo-Japanese War, and by 1907 ten additional craft of the Lake type had been completed for the Russian Government. Numerous offers were received by Lake from foreign countries for his patents and he was frequently called in consultation by the

heads of various governments. For the Austrian government his company built the "U 1" and "U 2." The German government also had access to his plans, of which they doubtless made use in building the fleet that for a time threatened the existence of English speaking civilization.

It was Lake's strong desire that these children of his mind be adopted by his own country, and his success abroad attracted so much public attention in this country that the existing monopoly in submarine construction enjoyed by his competitors could not be strictly maintained. In 1908 he received his first contract from the United States government, under the exacting conditions that his product should be superior in performance to any boat then built or projected by the United States or any foreign government. Under these conditions the "G 1" was completed in 1912, and successfully passed the rigorous tests to which it was subjected. Two additional submarines, the "G 2" and "G 3" were then built for the United States government, the "G 3" being the first vessel to be constructed in the yard which the Lake Company had acquired at the foot of Seaview Avenue in Bridgeport. The position of the submarine as an efficient arm of national defense was now established, and under further Congressional appropriations three additional underseas craft were contracted for in 1914.

Then came the great European War, and in 1914, in anticipation of the inevitable demand, the Bridgeport plant was expanded from 3½ acres to 29 acres, with corresponding increase in technical and supervisory staffs. From February 1915 to July 1917 contracts were made with the Federal Government for 12 more

vessels, and on a later date arrangements were entered into for four double-hull submarines, the "S 14" and "S 17."

The Lake Torpedo Boat Company was at this time in the zenith of its activities and possessed the unique distinction of being the only ship-building plant in the world devoted exclusively to submarine development and construction, the maximum number of employees being about 2,500. The last vessels made by this company for the United States Navy Department were the "S 48" and "S 51" in 1919. These craft embodied many of the ideas developed during the War and are considered by Naval authorities to be the best submarines now in the government service.

The program of economy which was naturally adopted by the government after the Treaty of Versailles was followed by the adoption by the United States government of the policy of designing and constructing its own submarines in governmental yards. For these reasons no new business was available, the company's trained personnel was disbanded and the ship yards finally disposed of in June 1924.

All of the forethought, financial risk and inventive genius devoted to the development of the submarine came from private sources. Not until Lieutenant Weddington astonished and shocked the Naval conservatives by sinking three of England's cruisers, the "Hogue," the "Cressy" and the "Avoukir," within an hour of each other, was the outstanding lesson of the World War beaten in upon the minds of the navies of the belligerent powers.

From the casting of the first cannon from Salisbury ore in the days before the Revolution to the huge muni-

tion plants and highly perfected undersea craft of the World War is a far cry. During this dramatic period the epoch-making contributions of Bushnell, Whitney, North, Colt, Sharps, Hobbs, Winchester, Lake, and many others have kept the "Land of Steady Habits" in the vanguard of munitions producers.

VEHICLES AND ACCESSORIES

EACH new stage in the development of civilization has been marked by improved methods of transportation. From the crude and cumbersome ox-cart, with its high percentage of useless weight and friction, down to our swiftest and most efficient aeroplane, each generation has turned a large share of its attention to improving this vital factor of society.

It is only to be expected then, that Connecticut, an innovator and leader in many other lines of industry, should be in the front rank here. Indeed this was the case until the last quarter of a century. Today, unfortunately, this once great Connecticut industry has faded to a mere semblance of its former importance. In the meantime, a thousand miles to the west, in a land that was still an uncharted wilderness long after Connecticut carriages were being exported to foreign countries, the great automobile industry has become localized.

The earliest carriage maker in Connecticut was John Cook, who established a business in New Haven in 1794, making what was the principle carriage of the period, the chaise, or gig. This was, of course, a two-wheel vehicle, four wheelers not coming in until about 1812. The construction of the first four-wheel carriage in Connecticut is generally accredited to Maltby Fowler of Northford, one of the famous family of inventors whose story is told in another chapter. The axles were of hard wood, but it had steel end springs. It was well into the century, however, before carriages came into popular use. This was partly because of their expense and partly because of the almost impassable roads of the period. The extension and improvement of roads and

the increase in wealth greatly stimulated the manufacture of vehicles, but for many years few were made here, except the very heavy carts, the English and French products occupying the field.

In 1809 a chance incident occurred which ultimately established New Haven as a carriage center. As we have seen in nearly every chapter of our industrial history, the industry in question revolved around the character and ability of a few individuals. The carriage industry is no exception to the rule. A young man, James Brewster, while travelling by stage was detained in New Haven by an accident to the coach. Walking at random about the town, he chanced upon Cook's carriage shop and had a conversation with its proprietor, which so interested him that he determined to locate in that town and enter the same business. At that time the annual production of carriages in New Haven amounted to $30,000. The product generally displayed poor and indifferent workmanship, the workmen being for the most part journeymen who were largely "paid in trade."

Brewster's first step was to attract to New Haven a superior class of artizans, offering high cash wages, and even inaugurating the startling innovation, everywhere commented on in early histories, of providing them evening lectures and scientific courses. Professors from Yale University, notably Silliman and Osted, were engaged to give these specially prepared courses. Brewster's principal salesman, John R. Lawrence, was later taken into the firm, which eventually became the famous concern of Lawrence, Bradlee and Pardee—a company which probably has constructed a greater variety of vehicles than any other in the country, ranging from a baby-carriage to the heaviest and most elaborate coach.

By 1860 it was exporting large numbers of vehicles to the Latin-American countries, Africa and Australia, it being generally understood that the American woods were more durable in warm climates and less liable to crack than the European products.

Other large carriage builders grew up in New Haven during the nineteenth century, as well as makers of such accessories as carriage hardware and fittings, springs and axles. Among these, some of the most famous were the Cook Carriage Factory; George T. Newhall; D. L. Wilcox & Sons; Miner & Wier; Wells, Crittenden & Company; the New Haven Wheel Company and the New Haven Spring Company. According to the census of 1860, of the 216 manufacturing establishments in New Haven, 41 were manufacturers of carriages and accessories. The next thirty years marked the height of the prosperity in this industry in Connecticut. In 1898 the number of concerns in the city was 252, representing a smaller number of plants than at an earlier date, but of much greater aggregate capacity.

One reason for the success of the industry was its early application of steam power. For this it is largely indebted to George T. Newhall, who on a journey to Rhode Island observed the wide-spread employment of this new form of power in that compact, highly-developed manufacturing area. He thereupon purchased and installed a small steam engine, his experiment being viewed with extreme pessimism by his competitors. Needless to say, it was successful, and it is doubtless to Newhall's establishment that Chauncey Jerome refers when he says in his "History of American Clockmaking"—"I live in the immediate vicinity of the largest carriage manufactory in the world, which *turns out a*

finished carriage every hour!—much of the work being done by machinery and systemized in much the same manner as clockmaking."

The New Haven Wheel Company, with which the Wilcox sons were also connected, was for many years the largest concern in the United States engaged exclusively in the production of wheels. Bishop, writing in 1860, states that "their machinery is new, much of it invented by themselves or manufactured expressly for their use, and is capable of turning out wheels, spokes, hubs, and fellowes with astonishing rapidity and remarkable accuracy. They keep constantly on hand a stock of about a million spokes finished in the rough." About half of this company's business was for export.

The fate of all these thriving companies was inevitable. Practically the last of the larger concerns, the New Haven Carriage Company, was liquidated in 1924. Organized in 1836 by John Holcomb of Branford, it was first called Holcomb Brothers, but in 1880 it was moved to New Haven and the final name adopted, the new plant being located on the ground on which soldiers were trained before being sent forward in the Civil War. The company manufactured fine carriages and buckboards, one of its officers, William Hooker Atwood, having been considered a leader in the industry and appointed United States Judge of Vehicle Transportation at the Chicago and St. Louis Expositions. This company was among those which attempted to readjust itself to the automobile industry, but these efforts were not generally successful, except in the case of the manufacture of hardware accessories. In 1900 the New Haven Carriage Company was sold to the Electric Vehicle Company of Hartford which was organized

to build electric vehicles for public service at the very outset of the horseless era; but the enterprise was likewise unsuccessful. The gasoline car was being perfected, and for a few years, while the automotive industry was still in the developmental stage, the company returned to the manufacture of carriages. In 1907 its last carriage was built. For a while the company maintained a profitable business building automobile bodies, especially for foreign chassis; but gradually the makers of motor cars, already firmly established in the Middle West, attracted the body business to their own vicinity. In chronicling the liquidation of this last survivor of the big carriage builders, one of its former officers remarks with philosophic resignation: "With plenty of capital, no indebtedness, buildings and real estate unencumbered and a fine stock of materials, we are just easing out, and, I guess, following the footsteps of many others in New England. A friend of mine once made the statement that manufacturing concerns were like individuals—they had an allotted time and then dropped out of line like human beings." The C. Cowles & Company of New Haven continue to manufacture carriage hardware, being one of the oldest accessory manufacturers; as are O. B. North & Company, manufacturers of saddlery and carriage hardware.

The manufacture of carriages in Bridgeport and South Norwalk, although less extensive, was considerable, the largest factory being that of Mott & Burr in Bridgeport. There were between fifteen and twenty manufacturers of carriages and parts in the locality and their history is similar to that of New Haven. In Greenville, a part of Norwich, there flourished for many years the Mowry Axle & Machine Company, estab-

lished in 1845 by Samuel Mowry, a wealthy cotton manufacturer. This company had a wide reputation for axles and springs, which it constructed from the famous tough Salisbury iron, under improved patents. It also manufactured carriage-building machinery, notably the "Reed and Bowen Punch," the "West American Tire Setter," and other devices, the names of which were familiar to nineteenth century carriage makers.

In New Haven it is interesting to note that, while the old carriage industry has inspired a few automobile body building companies, there is also another vehicular survival in the making of basket carts and baby carriages. Reed working companies have flourished in the city. Nor should one peculiarly Yankee invention be omitted—that of the three Dann brothers who founded the Rattan Manufacturing Company in 1857. During the Civil War, while the company was building army wagons for the government, John A. Dann experimented with the idea of a folding chair which he thought would be a convenience as it could be easily packed in army wagons for use in camps. He perfected such a chair and the company became the first to manufacture the now common folding chair—whence its usual name—"camp chair." For some years this was the company's chief product. This company, too, now manufactures baby carriages and go-carts, having been the first to devise and produce those of the reclining type. The Dann brothers also founded Dann Bros. & Company, specializing in bent wood, which produced a bent-wood bicycle rim with a "spoon lapped joint." The company furnished to Commodore Peary the bent wood for the sledges with which he reached the North

AMOS WHITNEY

The son of Aaron and Rebecca Perkins Whitney was born in Biddeford, Maine, October 8, 1832. After a common school education in Maine, Exeter, N. H., and Lawrence, Mass., he was apprenticed in the last named place to learn the machinist's trade in the Essex Machine Company at the age of fourteen. After being with the Colt's pistol factory from 1850 to 1854 he went with the Phoenix Iron Works where he met Francis A. Pratt. Although they remained with that concern until 1864, together they were working on the inventions which led to the forming of the Pratt and Whitney Company. Mr. Whitney was a director of many corporations but even after he had withdrawn from active leadership in his company, he kept in close personal touch with his men. On September 8, 1856, he married Laura Johnson and they had three children, Nellie Hortense, Nettie Louise, and Clarence E. Whitney, the founder of the Whitney Mfg. Co. Amos Whitney died August 5, 1920.

[illegible] education in Maine [illegible] Exeter, N. H., [illegible]
[illegible] was appointed in the [illegible]
[illegible] machinist's trade in the [illegible]

[illegible] factory from 1856 to 1858 he [illegible]
[illegible] Works, where he met Francis [illegible]
[illegible] connected with that concern [illegible]
[illegible] were working on the invention [illegible]

[illegible] Whitney was a director of that company [illegible]
[illegible] after he had withdrawn from [illegible]
[illegible] his company, he kept up [illegible]
[illegible] On September 8, 1886, he [illegible]

[illegible] Louise, and Charles E. Whitney [illegible]
[illegible] the Whitney Mfg. Co. Amos Whitney died
[illegible]

Amos Whitney

Pole, one of the sledges being now in the Museum of Natural History in New York.

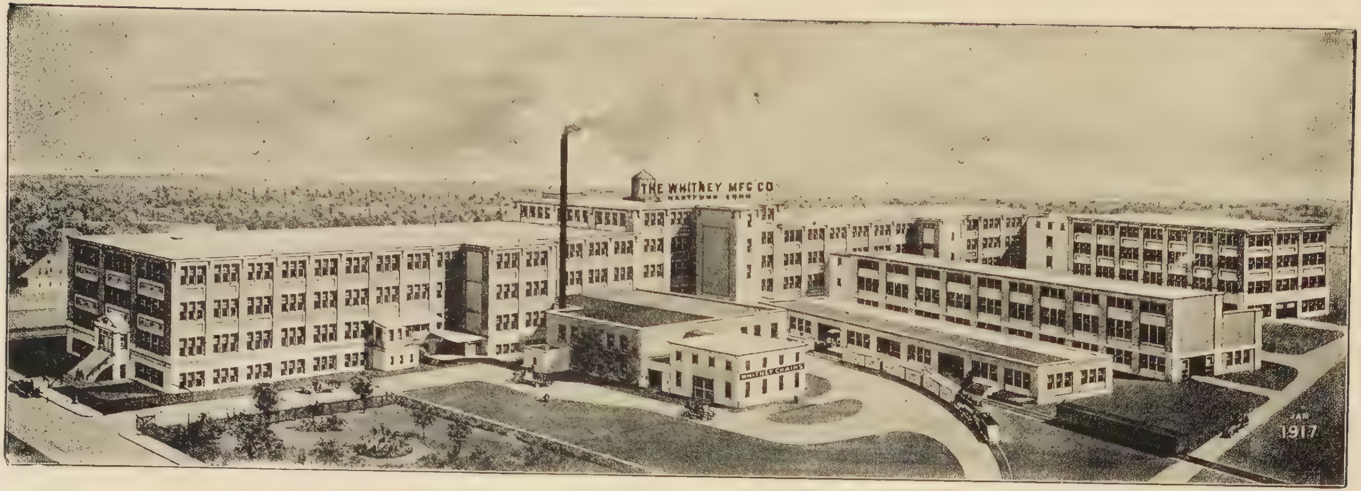
As we have repeatedly pointed out, Connecticut industry has been quick to take advantage of changed conditions. This was true of the revolutions in transportation effected by the successive advents of the bicycle and the motor car. In 1878 Colonel Albert A. Pope of Boston contracted with the Weed Sewing Machine Company of Hartford to manufacture for him a few Columbia bicycles—an innovation in which he was interested. The skilled mechanics of the company devoted much time to perfecting the machine, and soon the bicycle ceased to be a plaything and the craze swept the country. The Weed Company had been for some time on the verge of failure and Pope purchased it in 1890, renaming it the Pope Manufacturing Company. It was capitalized for $1,000,000. In the two decades following Pope's exhibition at the Centennial Exposition in Philadelphia of the first modern bicycle, which had been imported from England, factories to manufacture the "Columbia" were developed in Hartford. At one time they employed over five thousand hands, and, according to the census of 1900, Connecticut stood fourth in the production of bicycles. The Hartford Rubber Works, whose history is elsewhere recorded, was purchased by the Pope interests to manufacture tires and tubing. The Columbia was for a time merged with the American Bicycle Company, Colonel Pope retiring from the active management, but the enterprise was later recalled and headquarters reëstablished in Hartford.

With the advent of the automobile, Colonel Pope turned his attention and name to the production of the

old "Pope-Hartford" car with its ample power and bell shaped radiator, which is recognized as having been one of the best of the early makes. Both the "Pope-Hartford" and the "Pope-Toledo," were manufactured by the Pope interests, each in the city named; and the unfortunate failure of the company in 1912 has never been attributed to any defect in its products.

Two large companies which were started as manufacturers of bicycle accessories have since advanced to prominence in the automotive field, the Whitney Manufacturing Company of Hartford and the New Departure Manufacturing Company of Bristol. At the time the Whitney Manufacturing Company was organized, its products consisted only of the well-known "Whitney" Keys for the Woodruff system of keying, a small hand milling machine for sinking the keyseats, and a line of quick-change chucks and collets, known as the "Presto," for use in drill presses. The advent of the bicycle started the Whitney Company in the manufacture of driving chains, which through the introduction of the automobile increased the company's business in this line to a large volume. It first produced a chain of the roller type, and later a chain of the silent type. These lines have been so developed that driving chains now comprise the greater part of the company's output.

In putting out its roller chain the Whitney Company introduced a number of special features, among which was the use of cotter pins to secure the rivets in place, so that the chain could be easily taken apart or put together at any joint, in case of repairs or changes in length. The company also developed an entirely new line of roller-chain standards, giving larger rivets, bushings and rolls, which greatly increased strength and



The Whitney Mfg. Co., Hartford, Connecticut.

efficiency; and these standards were later universally adopted in this country. When self-starters and lighting equipments were developed for automobiles, a new and very large field for chains of the silent type was created, and nearly all of this particular business came to the Whitney Company, because of the special adaptability of its designs for the small-size chains required. At a later date the company developed a similar chain, especially high in quality and finish, for the camshaft or timing chains in the fronts of motors. This chain is now being recognized throughout the country, on account of the records it has established for highest mileage and a minimum of elongation.

The New Departure Manufacturing Company of Bristol, now the largest makers of ball bearings and bicycle coaster brakes in the world, began business as The New Departure Bell Company in the late fall of 1888 and was incorporated on June 27th of the following year for the purpose of manufacturing a new and patented type of door, office and call bells. The bell strikers were operated by springs, such as are commonly used in alarm clocks. The spring was released by pressing a button and re-wound by winding the gong. The unusual name adopted by the company originated in the fact that the bells were a "new departure" from the kinds then on the market. The company name has remained, but the word "bell" was long ago dropped and the word "manufacturing" substituted therefor, because of the extension of the company's products to other lines.

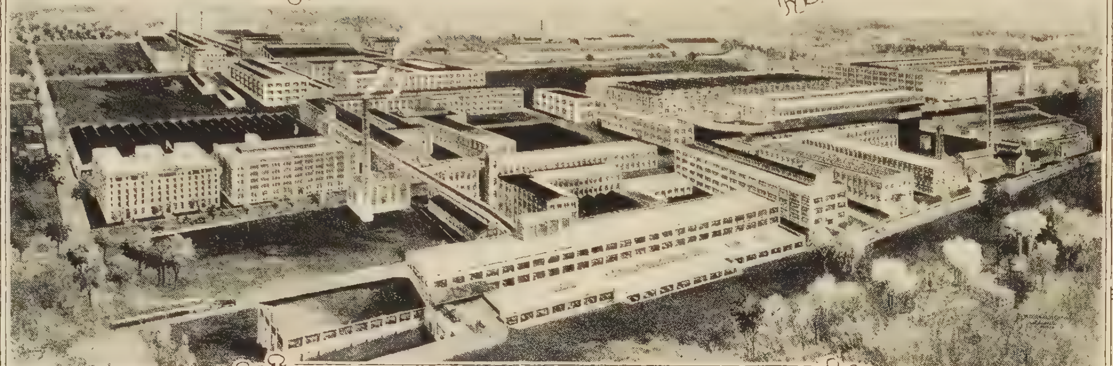
The start of the New Departure Bell Company was in the H. C. Thompson Clock Company's factory in Bristol, where the bells were made by that firm under

contract. From three to six hands were employed, including executives. The push button bell was only moderately successful, although business developed that made it desirable to remove to large quarters in the "old Jones building," which still remains a part of the New Departure plant. Until 1891 only a part of one floor was occupied, when a line of bicycle, fire, ambulance, and car bells was developed with a rotary striking mechanism operated by thumb lever. The bicycle was approaching its hey-day at that time and the business of the company in bicycle bells became so large that Bristol was for a time known as "The Bell Town." In the early Nineties the company developed the New Departure bicycle "controller," which was a braking mechanism. That was quickly supplanted by the New Departure coaster-brake, invented by Harry B. Townsend as a result of his experimental work on the controller. The coaster brake has been described as equalling the invention of the pneumatic tire, in its importance to the bicycle industry. As the company continued to grow, additional bicycle sundries were manufactured, principally the New Departure cyclometer. The coaster brake patent rights extended to the leading European countries where factories were established on the outskirts of Berlin, Germany, and later in England.

In the development of the coaster brake, steel balls were employed in pressed steel containers and the company was one of the first in America to manufacture balls of this kind. In 1907 the company equipped a modern plant for producing the double-row or combined radial and thrust ball bearing. This was an entirely new design. Later the "Single Row," "Radax," "Magneto," and "Front Wheel" types were added to

Administration Building

Original Home of New Departures



Birdseye of New Departure Plants -- 1924

Endee Inn and Club

Hospital Department

Endee Manor

Fire Department

New Departure Band

New Departure Championship Base Ball Club

New Departure Drum Corps

New Departure Orchestra

complete the line. At that time, high grade ball bearings were used almost exclusively in motor cars and imported from Europe and the company at first experienced difficulty in securing acceptance of the American product. The business grew steadily, however, until today it occupies over a million and a half square feet of floor space, and turns out upwards of 20,000,000 ball bearings and 1,500,000,000 steel balls per annum. A total of 82 buildings makes up this plant, with the main works and office located in Bristol and sizeable branch factories in Hartford and Meriden. Six thousand hands are employed and 21,000 metric tons of steel enter into New Departure products each year. Since January 1, 1919, the company has been an important division of the General Motors Corporation, which is the second largest industrial organization in the United States, the president of the New Departure being the vice-president of the General Motors Corporation.

To the sophisticated motorist, there is no more companionable device than the odometer, usually referred to in the language of the fraternity as the "speedometer." The odometer, or cyclometer as it is commonly termed when applied to bicycles, is of very ancient origin. That it was conceived before the Christian Era is evident from the fact that one is described by Vitruvius in a part of his work "De Architectura." As a convenience, if not an absolute necessity, it has been in continued use, under intermittent improvements, from an early period, and it has played its part in civilization's advance. Many of our state and county maps now in use were prepared by odometer surveys.

Originally and for many centuries a crude, heavy, unsightly instrument recorded merely the revolutions of

a wheel or disc. But the modern odometer is trim, light and symmetrical, and by an ingenious reduction of gears the miles and fractions are at once recorded. It is keeping well within bounds to say that the inventive and mechanical genius of the last twenty years has done more for the odometer than was accomplished during many preceding centuries, and this is due naturally to the incentive produced by the increased use of wagons, the perfection and universal use of the bicycle and to the more recent advent of the automobile.

Although the odometer's early employment was chiefly for surveying roads and land boundaries, increased means of transportation has created a larger field. The accuracy, reliability and practicability of the modern odometer is attested and emphasized by the fact that every course over which automobile endurance contests have so far been run in this country was laid out and measured by one. The same is true of the chartings of the well-known "Blue Book."

One of the leading concerns in the country engaged in the manufacture of this device is The Veeder Manufacturing Company of Hartford, which was organized in 1895 by Curtis H. Veeder, David J. Post and Howard W. Lester. Since that date there have been no reorganizations, consolidations or changes of name connected with the company. Its growth has been gradual and its experiments many. In 1897 Veeder invented an automatic die casting machine for casting accurately and uniformly in a vacuum small parts from a special metal alloy known as "Veeder" metal. Many of these machines are now in use in the Veeder plant. Another of the Veeder's inventions is the tachometer, a device used as a standard in the Bureau of Standards at Washing-

The Veeder Manufacturing Co., Hartford, Conn.
Manufacturers of Cyclometers, Odometers, Counters, Speed Counters, Tachometers, Fine Die Castings.

ton. It is also used by many of the larger electrical concerns as well as by manufacturers and in laboratories.

During the World War, the Veeder Manufacturing Company made and delivered to the government 100,000 counters for attachment to the magazine of the Lewis aircraft machine gun for the purpose of indicating the number of cartridges contained in the magazine at all times. When loading, the counter recorded each cartridge as it entered the magazine and, as each cartridge was discharged, the action of the counter was reversed and the number reduced by one. Counters that were operated by the recoil were also furnished the government for large guns during the World War, as well as many counters for numerous other purposes. The present output of the company is over $1,000,000 annually and it employs about three hundred and fifty hands. Its goods are sold throughout the world.

An example of the gradual diversion of industries from other lines to the automotive field is The Bassick Company of Bridgeport. This large concern has a mixed and interesting lineage. It was formed in 1917, its main constituent parts being the Burns & Bassick Company of Bridgeport, the M. B. Schenck Company of Meriden, and the Universal Caster and Foundry Company of Newark, New Jersey. The company now manufactures automobile and furniture hardware, and is an outgrowth of the caster business, some account of which is given in the chapter on "Tools and Builders Hardware."

The antecedents of the Burns & Bassick Company are interesting. In 1870, Charles F. Cook, of Scotch stock, came from the New Hampshire hills to Meriden and established the Meriden Screw Company, in 1878. S.

A. Burns joined him, and after a few years the name of the company was changed to S. A. Burns & Company. Later, the concern became known as Burns, Silver & Company and the business was moved to Bridgeport, where it was re-incorporated in 1895 and entered upon the manufacture of cabinet hardware in a new plant located between the New Haven railroad tracks and Austin Street. At this time Edgar W. Bassick came to the firm, and later W. R. Bassick joined its forces. In 1907 another member of the family, F. C. Bassick, became identified with the business. It was in 1909 that the firm was re-named The Burns & Bassick Company.

The origin of the M. B. Schenck Company, another of the underlying concerns of the Bassick Company, is also of especial interest. Martin B. Schenck, after his four years of training in the Civil War, left the service with a strained back which prevented him from lifting heavy articles. Being a hardware man, he faced a problem of moving and displaying stoves and other articles of considerable weight. This focused his attention upon the production of some easy device for moving these commodities, and, after various experiences, he built a set of small trucks, the frames of which were wood, mobility being secured by casters. This led to his study of the production of efficient casters, and in 1881 he came to Connecticut from Fulton, New York, and perfected a double-wheel caster, afterward called the "Yale" on account of its being manufactured in New Haven. Here he organized the Yale Caster Company. A disastrous fire, accompanied by other business troubles, compelled him to combine his business with that of Foster, Merriman & Company, a Meriden competitor elsewhere referred to. Later, however, he orgânized the

M. B. Schenck Company. Martin B. Schenck died in 1911, leaving the business in the hands of his son, William A. Schenck. The dreams of the father have been realized and the present modern factories have been erected adjoining the original plant.

The other underlying concern of the combined Bassick Company, The Universal Caster & Foundry Works, finds its origin in Brooklyn, New York, where, in 1883, Albert B. Diss was employed as its mechanical engineer. The concern was engaged in manufacturing a new type of furniture-caster, having a steel screw stem which had recently been invented by George Rice. The device proved impractical and too expensive to stand up under competition, and in 1885 the Empire concern failed. Thereafter Diss formed the A. B. Diss Company and started manufacturing and selling steel-horn Philadelphia casters. In 1904 the A. B. Diss Company combined with the Standard Caster and Wheel Company of New York and John Toller's Sons Company of Newark, forming the Universal Caster and Foundry Company.

In the meantime the automotive field had developed and the Bassick Company took advantage of the opening and began the production on an extended scale of accessories for this great modern industry. The new organization did not get under way before the United States entered the World War. Immediately upon the entrance of the United States into the contest, the entire facilities of these three plants were offered to the government. Almost over night the factories were turned into munition plants. Billions of bronze loops for canteens, saddle buckles and hundreds of special articles were made during the eventful year and a half that followed. When the Armistice was signed on November

11, 1918, the company was delivering to the army 50,000 hand grenades daily. After its organization the Bassick Company purchased the Heron Manufacturing Company of Utica, New York, and moved its equipment to its Meriden plant. The history of the various underlying concerns and their combination under the present name has been given in some detail because of the fidelity with which they typify the modern tendency toward consolidation.

Prominent among the carriage accessory manufacturers who successfully weathered the transition to automobile accessories in New Haven is the English & Mersick Company, manufacturers of automobile body hardware and fittings. Established in 1853, by two hardware clerks who believed that there was an opening for a hardware shop specializing in carriage hardware and findings, it remained for twenty-five years a wholesale house only. About 1878, however, Frank P. Pfleghar, who had been operating a small machine shop nearby, rented space from the company and began to manufacture a few of the articles extensively sold by the firm. In 1896 one of his steel cylinders containing acetylene gas under 3000 pounds pressure exploded and the consequent fire destroyed the building. Upon rebuilding, Pfleghar retained his quarters with the English & Mersick Company and after his death the Pfleghar Company was purchased by the English & Mersick Company. Since that time the variety of products has increased and the output extended to such automobile accessories as windshields, radiators and door locks, as well as interior fittings.

The Whitlock Coil Pipe Company of Hartford was the first concern in the country to make engine-cooling

One of New Haven's Oldest Industries
Furnishing Vehicle Supplies for over Seventy Years

radiators on a production basis, and are, with the English & Mersick Company, and the G. & O. Manufacturing Company, also of New Haven, the leading automotive radiator manufacturers in the State.

The Westinghouse Air Spring Company of New Haven was founded by George Westinghouse, inventor of the air brake and founder of the Westinghouse industries. The inspiration of the Westinghouse air spring for motor cars can be traced to an amusing incident. One October day, 1908, Westinghouse was riding in a big limousine to a wedding reception in Lenox, Massachusetts. The chauffeur failed to see a "thank-you-marm" and hit it at full speed. Westinghouse was a man of bulk and the wreck of his silk hat and the fracture of his temper stimulated his inventive mind to consider the possibility of some method of cushioning direct blows and controlling the recoil throws of steel springs in motor cars. Naturally his first thought was of compressed air. His first air spring, perfected in 1910, was a substitute for both steel springs and pneumatic tires. The inventor rode thousands of miles on cars with solid rubber tires without springs, but eventually it was decided to return to these two essentials. Just as the spring was ready for commercial development and the enterprise moved from Troy to New Haven, the inventor died. His death, and the war immediately following, retarded the growth of the concern, but within the last two or three years the business has become firmly established and its growth has been rapid.

In the Bridgeport district, there are several important automotive industries. Perhaps the best known of these is the Raybestos Company. This company in

1905 inaugurated the use of asbestos brake linings for automobiles. With the coming of the motor car and its development of speed, the question of brakes, for which wooden blocks against the wheels had sufficed for horse-drawn vehicles, became vital and a scientific study of the problem of safe stopping was undertaken. The Raybestos Company, then and until 1916 known as the Royal Equipment Company, first made a lining for automobile brakes of cotton, treated with a heat-resisting compound of woven cotton yarn saturated with paint. Such lining was preferable to metal for various reasons, but it was found that the cotton was, even when so treated, destroyed by heat. This led to the adoption of asbestos for the purpose, brass wire being woven into the asbestos yarn, which was then saturated with pitch. This treatment of asbestos fibre has since come to be the accepted brake lining for the automotive industry. The Raybestos product, however, was the original. The company now holds valuable patents for a wrapping type of brake, and for woven and molded clutch facings. They were the originators of woven clutch facing for multiple disc clutches, running both in oil and dry.

The Vacuum Muffler Corporation of America is another Bridgeport concern whose product is well known to the automotive industry. This company manufactures a muffler for trucks which employs the reaction of the gases to kill their action, thereby eliminating the noise of the exhaust. The vacuum muffler is standard for over eighty truck and tractor manufacturers in the United States and Canada. Another survival from the carriage era is the Spring Perch Company of Stratford, which was a pioneer among leaf spring

manufacturers in the country, having been founded in 1848. Its output is now absorbed by the automobile industry.

Among the oldest Bridgeport companies is the White Manufacturing Company, founded in 1832 as Rippen & Sturges, and continuing successively as White & Bradley and the Thomas P. White Company, the present name being adopted in 1863. They are well-known makers of coach lamps and carriage hardware. With the death of the carriage industry, the company began to manufacture automobile lamps. The company presented to President McKinley a pair of carriage lamps made entirely of the first American tin-plate produced after his tariff law went into effect protecting the industry. This company has specialized and attained distinction in the production of hearse lamps and trimmings—not only in the United States but abroad.

In concluding this chapter, however, it is gratifying to be able to chronicle the vitality of the production upon Connecticut soil of one of the most famous machines in the history of the automobile industry. That is the "Locomobile." The ancestor of this old and high-grade car was a steam-propelled vehicle built at Newton, Massachusetts in 1898 by John Brisbane Walker and Amzi L. Barber. In the year following, Barber founded the Automobile Company of America, the concern being incorporated under the laws of West Virginia in June of that year. A month later, the name of the firm was changed to the Locomobile Company of America and the business transferred to Bridgeport (1899). Under this firm name the concern continued to produce until 1920, when it was dissolved and its assets transferred to a new corporation, styled The Locomobile Company.

Under this new arrangement, the merchandising was carried on by Hare's Motors, Incorporated. This combination not proving successful, a creditors' committee took charge of the business in 1922. Under court orders, the assets of the Locomobile Company were transferred to a new corporation known as the Locomobile Company of America, Incorporated, under which name the business is now conducted. The real purchaser of the property, however, was W. C. Durant of New York City, president of the Durant Motors, Incorporated, a name well known in the automobile world.

As has been said, the first products of this concern were steam-propelled vehicles, but in 1902, under the direction of Andrew R. Riker, there was built the first Locomobile four-cylinder gas-propelled car. This was later supplanted by the well-known Locomobile "Six." During the World War one hundred per cent of the plant's personnel and equipment was devoted to the manufacture of "Riker" trucks, "Mark VIII" tanks and a very few Locomobile sixes. The company also produces the eight-cylinder "Junior" car. The present annual output of the plant is 500 six-cylinder cars, and 5,000 eight-cylinder cars.

During the World War, General Pershing, Commander-in-Chief of the American Forces of Occupation in France, and the members of his staff, were supplied with a fleet of Locomobile limousines, the specifications for which called for a maximum speed of 80 miles per hour. Not only speed, but rugged strength and extreme durability were required. Under conditions where the time-factor was vital, progress had to be made under road-conditions of the most appalling kind—and, indeed, as occasion required, even where there were no roads at all.

In this powerful product of Connecticut skill of design and thoroughness of construction, the leader of America's hosts shot through the lurid day and sped through the shell-lit night bearing the heart and hopes of his native land. If, indeed, the automobile industry of Connecticut has dwindled to this single concern, we may well say, as did the lioness when taunted by the she wolf with having but one whelp—"Yes, but it's a *lion*."

In commenting on the flight of the manufacture of boots and shoes from industrial Connecticut and its location in Massachusetts, we stated that this modest volume seeks to be primarily a history rather than a philosophical discussion of causes and effects. The same may be said of Connecticut's partial loss of the automobile industry. In two instances, mismanagement has been a factor. In other instances Connecticut concerns noteworthy for their able and conservative management have produced motor cars, and subsequently given up the business. The great Corbin interests of New Britain produced and marketed the "Corbin" car. It was a creditable product, but its manufacture was short-lived. The State must evidently rest satisfied with its great and increasing production of automotive accessories, and yield the main field of the making and assemblage of cars to other sections.

RUBBER PRODUCTS

THERE are few more impressive examples of industrial evolution than the history of vulcanized rubber. Based on a discovery made in 1839, rubber in its numerous forms is today a necessity in any civilized community, contributing to the health, safety and comfort of mankind. It is to Connecticut again that one must turn for the story of the development of this important commodity.

Rubber, in a crude form, had been vaguely known since medieval times. Its earliest mention occurs in a general history of the Indies written in 1536 by Gonzalo Valdas of Spain, in which he describes an Indian game of "batey" played with a gum ball. Little or nothing was known of the substance until Charles de La Condamine, a Frenchman, discovered it in South America in 1736. This was the *Hevea Brasiliensis* species, which thrives on the borders of the Amazon, and is the most profitable of all rubber trees known today, yielding the celebrated Para rubber. La Condamine sent a sample of this rubber to the Institute of France and gave the first accurate information regarding *Hevea.*

In 1770 Joseph Priestly of England speaks of rubber as being used to erase pencil marks and says that it costs "three shillings for a cubical piece of about a half inch." In 1793 Besson of France used rubber in making water-proof cloth. In 1820 Badier of England developed a method of cutting rubber into sheets and threads. In 1823 Charles Mackintosh of Glasgow began the manufacture of water-proof cloth with India rubber and coal tar naphtha. Hence the familiar term "Mackintosh" for a water-proof garment.

The history of the rubber industry in the United States may be said to date from 1825 when one Thomas Hancock began to manufacture rubber boots and shoes. Prior to that date rough shoes made of rubber gum were imported from South America, principally from Brazil. Hancock began to import raw material and make crude rubber foot-wear. This product was unsatisfactory and did not prove a commercial success, owing to the fact that the material was subject to rapid deterioration, especially in summer, when the unfortunate wearer's feet clung tothe pavement and his galoshesclung to his shoes. It was no uncommon thing for a merchant to find the rubber goods on his shelves stuck together in a hopeless mass, thus reducing the stock to a total loss. In winter, on the other hand, the rubber became stiff and brittle. It seemed indeed that the elements of all seasons were in league against the commercial use of the substance. In 1832, Lundersdorf observed that sulphur removed the stickiness of rubber. About this same time an American by the name of Hayward made the same discovery, but in neither case was the knowledge applied on a practical basis.

It was at about the year 1834 that Charles Goodyear happened to see some rubber goods and, upon inquiry, discovered the troubles which the manufacturers and retailers were then experiencing. This was a memorable day in the history of rubber. Goodyear promptly set to work to try to find some method of treating rubber that would overcome the difficulties. He found his problem to be a hard one. He was poor and without any special technical training, although he had inherited an inventive genius from his father, a resident of Naugatuck, who had been the author of several inventions.

During his long quest he was often in financial difficulties and his family in great want. It is said that at times they even broke up their pieces of furniture for fuel in the home.

His great discovery—the vulcanization of rubber—occurred by chance. In 1839, in Woburn, Massachusetts, to which place he had gone with his family to be near an abandoned rubber factory, Goodyear was working one day over the kitchen stove, when a spoonful of rubber mixed with sulphur fell into the fire, and led to the discovery that a mixture of rubber and sulphur, when subjected to heat, underwent the "change" necessary to make it commercially valuable. Then began the long task of perfecting this idea, and working out a method of manufacture which would produce goods that would meet with public approval. For a time he continued working at Woburn, and then moved to Springfield, Massachusetts. Finally he received a promise of financial aid from his brother-in-law, William DeForest, who had established a woolen factory at Naugatuck. Goodyear then shifted his residence to Naugatuck, first setting up in a small building in Union City, adjacent to the town, and continued his experiments, backed by DeForest, the latter receiving, of course, a promise of a substantial interest in anything of value the inventor might develop.

Between the years 1839, when the spoonful of rubber fell into the stove, and 1843, Goodyear was working ceaslessly trying to perfect his manufacturing methods to the point where salable goods could be produced. His work during this period was that of an experimenter rather than of a manufacturer. He did turn out a considerable quantity of goods of many varieties, but

Charles Goodyear, 1800–1860
Discovered the Process of Vulcanization of Rubber. From Painting in the New Haven Colony Historical Society.

they were all haphazard in quality, some fairly satisfactory, but most of them of a poor character. Goodyear never became a manufacturer, as such, his whole effort being devoted to experiments to bring his discovery to the point where it could be of more service to mankind. He frequently lamented the fact that his progress was so slow that many lives were being lost at sea which might be saved, could he but perfect a rubber life-saver.

In 1843 he felt that he had gone far enough to take out his first patent, and in that year he began to issue licenses to manufacturers to operate under his patent. DeForest had been successful in his business and had loyally stood by Goodyear, his loans to this time reaching close to $40,000. Then DeForest himself got into financial difficulties and was shortly compelled to go through bankruptcy, but the manufacture of rubber goods under the Goodyear patent had already begun and the business failure of DeForest did little more than to prevent Goodyear from having access to ready funds for his work. It is interesting to note that he gave all of his first licenses to Connecticut manufacturers. Licenses to make rubber foot-wear, for many years the most important factor in the rubber industry in this country, were given to the L. Candee & Company of New Haven and the Goodyear Metallic Rubber Shoe Company of Naugatuck. As both of these companies became prominent, the details of their organization and development will be of interest.

When Goodyear was working at Woburn, Massachusetts, he had associated with himself one Hayward. One day Hayward was visited by Leverett Candee, then a manufacturer of elastic suspenders at Hamden.

Candee requested Hayward to make him a practical rubber shoe. It was not until 1842, however, that Goodyear and Hayward were able to supply Candee with satisfactory samples. The next year, 1843, Candee began to manufacture rubber in an experimental way at Hamden, a suburb of New Haven. In that same year Charles Goodyear gave him a license to use the vulcanization patent in the manufacture of rubber shoes. Candee's capital had been exhausted in previous unsuccessful adventures, and in establishing the rubber factory he enlisted the aid of Henry and Lucius Hotchkiss, at that time lumber merchants in New Haven. On September 5, 1843, L. Candee & Company was formed, with Candee and Henry and Lucius Hotchkiss as partners. The following year, Abraham Heaton was admitted to the firm. He added $3,000 to the capital of the business, making it $9,000 in all. The company's factory was finally located on Chapel Street, New Haven. Henry Hotchkiss bought out Heaton in 1847, and so rapidly had the business of the company increased that in 1852 a joint stock company was formed with a capital of $200,000. In 1869 this was increased to $300,000. The four original subscribers to the capital stock were Candee, Henry and Lucius Hotchkiss and Timothy Lester. They were also the original directors of the company. In 1863 Candee sold his interest in the company to Henry Hotchkiss, withdrawing from the corporation.

The Hotchkiss family has from those early days played an important part in the rubber history of America. Henry L. Hotchkiss, son of Henry Hotchkiss, has been president and treasurer of L. Candee & Company since the death of his father in 1871. He has been a director of the United States Rubber Company since its

formation in 1892, and for many years was a member of its executive committee. For half a century, little of importance has occurred in the rubber foot-wear industry in which he has not had a part. His son, H. Stuart Hotchkiss, who served his apprenticeship in the rubber industry at the Candee plant, is vice-president of the United States Rubber Company, and is in charge of all that corporation's crude rubber activities, including their great plantations in the Far East. In rubber circles, the Candee factory is generally credited with being the oldest Goodyear licensee still in existence. However, the Goodyear Metallic Rubber Shoe Company at Naugatuck disputes this honor. Although the Candee license was the older, probably the Naugatuck company actually manufactured first.

The two Naugatuck companies—the Goodyear Metallic Rubber Shoe Company and Goodyear's India Rubber Glove Manufacturing Company—were established through the efforts of William DeForest and Milo Lewis and his three sons, Samuel J., William and Thomas. DeForest was interested only in a financial way, but the Lewises were engaged in actual manufacture of woolen gloves and mittens at Litchfield, and DeForest secured for the establishment in 1844 a license for making rubber gloves. The business moved to Naugatuck in 1847 as Goodyear's India Rubber Glove Manufacturing Company, and confined itself to making gloves until just before the Civil War. Samuel J. Lewis & Company became the Goodyear Metallic Rubber Shoe Company and was incorporated January 9, 1845, with a capital of $30,000, the subscribers being William DeForest, Samuel J. Lewis, William H. Elliott and Milo Lewis. This firm immediately engaged in the manu-

facture of rubber footwear and has been from that day to this one of the dominant rubber footwear factories of the country.

The following account of the first successful effort to vulcanize India rubber overshoes was set forth a number of years ago in a letter by Charles DeForest, son of William DeForest: "Mr. Goodyear, the inventor, Mr. Milo Lewis, Mr. Samuel J. Lewis, and Mr. Elliott of New Haven met in my late father's woolen factory at Naugatuck, Mr. Goodyear having provided materials and lasts, for the purpose of vulcanizing a rubber shoe on the last. He had brought with him his eldest daughter, my late wife of blessed memory, with the materials and there she made the first pair of rubber overshoes, afterwards vulcanized in the little shop at just about the present location of the great plant of the Goodyear Metallic Rubber Shoe Company. From this modest effort has come this great enterprise of scores of millions of pairs yearly." These two rubber companies at Naugatuck went along side by side until 1892, when they were taken over upon the formation of the United States Rubber Company.

Another early company to operate under the Goodyear's patents was the Naugatuck Rubber Company, organized in 1845, to manufacture shoes, druggists' sundries and army and navy equipment. This company was deeply indebted for its success to the outbreak of the California gold fever, for no sooner had it begun to produce rubber blankets than these came into great demand as essentials for the pioneer outfits of the Forty-niners. This boom was followed in turn by the Civil War, when, under the name of the Phoenix Rubber Company, later the Union India Rubber Company, millions of blankets

were supplied for the army. Under the latter name a factory was opened in Middletown for the manufacture of rubber garments. This later became the Goodyear Rubber Company and the product was changed to footwear.

Middletown is also the domicile of other important rubber-textile interests, the most important of which is the Russell Manufacturing Company which was the original producer of "gum elastic" suspenders and now ranks as one of the leading manufacturers of elastic webbing in the country. As early as 1864 the town had five sizable mills engaged in the manufacture of suspenders, elastic webbing for the sides of the "Congress Boot"—at one time the acme of dandyism—and other woven elastic goods. The Omo Manufacturing Company, makers of dress shields and other rubber specialties, is the more recent rubber manufacturer of the city.

In 1851, Charles Goodyear's brother, Nelson, discovered the process of solidifying rubber, making it susceptible to a high polish and to moulding. This is called "hard rubber." The process consists of using more sulphur and applying greater heat, and was developed in Newtown, Connecticut. License for the use of this process was disposed of to the American Hard Rubber Company, later consolidated with a New York rubber company. Hard rubber is used for many specialties. In Connecticut may be mentioned the H. P. & E. Day Company of Seymour, manufacturers of fountain pens and hard rubber novelties; and the Johns-Pratt Company of Hartford, manufacturers of "Vulcabeston," a patented lining compound used for brakes and similar purposes. As is elsewhere noted, this company has been recently purchased by Colt's Patent Fire Arms Manufac-

turing Company of Hartford. There are other important companies in New Haven, Bridgeport and the Norwalks engaged in the manufacturing of elastic webbing, waterproof garments, druggists' supplies, and hard rubber specialties—independent of the United States Rubber or Goodyear Tire & Rubber Company of Ohio.

The Seamless Rubber Company, Incorporated, of New Haven, manufactures hospital rubber goods, hard rubber combs, and rubber sporting goods. The company was formed in 1877, doubtless inspired by the success of the Candee Company, its original product being a seamless rubber nipple. Those previously manufactured were made in two parts and had a hard ridge down each side. This specialty gave the company its name, and it has since specialized in other seamless goods. During the post-war reaction the company went into the hands of a receiver, paying one hundred cents on the dollar to all creditors. It was purchased by the United Drug Company of Boston, and now operates one of the largest rubber sundries plants in the country and has from 1,200 to 1,800 employees.

The American Mills Company of Waterbury is another large and old manufacturer of elastic webbing, tracing its origin through the American Suspender Company and the New Haven Web Company of Hamden to the group of three or four original plants operating under Goodyears' earliest licenses. It later purchased another New Haven Company of similar nature, the Narrow Fabric Corporation of Orange. The company was formed under its present name in 1881 by several of the Waterbury brass manufacturers for use in connection with their small metal trimmings for suspenders, and other products. The company is estimated to do an

annual business of about $3,000,000, and has about 1,000 employees. During the war they were large manufacturers of cartridge belting and machine gun belting.

Bridgeport has several rubber works, notably the two Canfield companies: the H. O. Canfield Company, makers of hard rubber goods, and The Canfield Rubber Company, makers of rubber dress shields and bathing caps. There are also a dozen or fifteen companies engaged in the manufacture of elastic webbing, mostly either for or in connection with the corset industry there. There is also a company, The Housatonic Machine & Tool Company, exclusively manufacturing machines and moulds for rubber goods.

In Sandy Hook, in 1841, rubber manufacture was also begun in an experimental way when Nelson Goodyear and Henry Alden made rubber coats in the rear of a store. Two years later Josiah Tomlinson here established a factory, but failed, and was succeeded in the same plant by Frame & Graecon; and they, in 1846, by the New York Belting & Packing Company. In 1900 this latter firm, then a subsidiary of the United States Rubber Company, removed to Passaic, New Jersey, many families going with them. The Fabric Fire Hose Company, another of the subsidiaries of the United States Rubber Company, was transferred in 1901 to Sandy Hook, where it continues to operate.

Although the need for rubber shoes and garments and elastic webbing was responsible for the early development of the industry, it is a more modern necessity which has brought it to its present gigantic proportions, which is, of course, the use of rubber for tires. Although the automobile has removed the vehicle center from Connecticut to the Middle West, and has taken the

bulk of the tire manufacturing with it, Connecticut retains a fair share of the present production and the chief credit for its origin.

In 1881, John W. Gray of Hartford, operator of a retail store, purchased the land which is now part of the site of The Hartford Rubber Works Company, and organized a company known as The John W. Gray Company, for the manufacture and sale of all kinds of articles composed in whole or in part of rubber. Gray erected the first building, a structure 50 x 60 feet, and equipped it with a 50 horse-power engine, one washer, three mixers and a calender; and with this equipment the Gray Company began the manufacture of rubber goods such as druggists' sundries and similar articles. The original force of men employed was twenty, including officers.

No clearer picture could be presented of the rapid development of the manufacture of the now overshadowing product of rubber tires than the bare chronology of the various steps in the growth of the Hartford Rubber Works Company—now a part of the great national organization of the United States Rubber Company.

In 1885, when the old, high-wheel bicycle was in vogue, the Gray Company started the manufacture of solid rubber bicycle tires. Three years later the company was incorporated under the name of The Hartford Rubber Works Company, with a capital of $20,000. Following is its chronology:

In 1891, the first single-tube tires were made at this plant.

In 1892, the Pope Manufacturing Company took over the plant, increased the stock to $200,000 and continued the manufacture of tires.

In 1897, solid vehicle tires for wagons and carriages were developed at this plant.

In 1899, the Rubber Goods Manufacturing Company became the majority stockholder of the company.

In 1899, the first solid motor tire was made at this plant, which has since been developed into the "United States" solid motor tire.

In 1900, the first "Straight Side" automobile tires were made at this plant. This tire was the "Dunlop," which had been brought to this country in 1896. It became the standard type in 1904, and is manufactured by all tire companies under their respective names—the highest type developed by this company being the United States "Royal Cord."

In 1903, the Clincher, "G. & J." double tube automobile tires were first made at this plant.

In 1905, the "Bailey Tread"—the first anti-skid automobile tire—was here manufactured under license.

In 1905, the "Midgley Tread" was developed at this plant.

In 1907, the "Quick Detachable" type was here developed.

In 1915, the "Chain Tread" type was put out.

In 1917, the Rubber Goods Manufacturing Company was absorbed by the United States Rubber Company, and since that date the plant has been operated by The Hartford Rubber Works Company, as the lessee of the United States Rubber Company.

In 1917, the United States "Royal Cord" tire, manufactured by the Hopkinson Flat Band method, was developed at this plant, and at the present time is the only method there in use.

During the forty years of its existence the plant had

grown until it had a floor space of over 400,000 square feet, and employed over two thousand hands. In July, 1919, the United States Rubber Company decided to enlarge the Hartford plant, and on October 27, 1919, ground was broken for the erection of a six-story, reinforced concrete building, three hundred feet long and one hundred and fifty feet wide, with a floor space of about one million square feet. This building was finished, and completely equipped with machinery in full production on October 27, 1920. The capacity of the plant is now over 10,000 tires per day. It has been operating almost continually, night and day, since 1906, and at present employs about three thousand hands. During the World War, it devoted part of its producing power to the manufacture of gas masks and rubber boots for the army.

As has been seen, the rubber industry, like the brass industry, has had a most valuable ally—undreamt of in its formative days—in the automobile. A great portion of the present rubber manufacture in America is of pneumatic tires. Their general history is pertinent to the account of rubber in Connecticut.

It was in the year 1845 that Robert W. Thompson, of England, applied for the first patent on pneumatic tires to be applied to vehicles. His patent related to "the application of elastic bearings around the tires of wheels of carriages, rendering their motion easier and diminishing the noise they make while in motion." In 1847 the "Scientific American" recorded the appearance of a rubber-tired carriage in New York. About 1868 European scientific journals were describing solid rubber tires (up to five inches thick) for traction engines on common roads.

Very little was recorded relative to the progress of these tires from 1845 to 1874, after which date a number of English firms took out patents for solid and cushion tires. In 1884 Mackintosh & Company of England applied for a patent on a tire having a hollow center to give added resilience—this being a definite departure from the solid type for bicycles. In the meantime a start in the bicycle industry in America was made, in 1878, by Colonel Albert A. Pope, in Hartford, who made a contract with the Weed Sewing Machine Company of that city to manufacture fifty bicycles to be equipped with solid rubber tires, seven-eighths inches in diameter. A few years later came the cushion tire with a diameter of about one and one-quarter inches, having a hollow space in the center to give added resilience. This tire did not meet with success, as the hollow core did not offer sufficient support. The hollow portion was then filled with water, which was found to be too heavy. Finally, air was tried and it was found that by this method the walls of the tire could be reduced in thickness, thereby lessening the weight; and so it follows that the single tube pneumatic tire was a direct outgrowth of the cushion tire.

The first pneumatic tire was brought out by Doctor John Boyd Dunlop, a veterinary surgeon, of Belfast, Ireland, who, in 1888 and 1889, obtained patents in England. Through this has come all subsequent developments in the pneumatic tire industry of the world. This tire did not find its way to America, however, until 1896. It was a straight-side tire. In 1890 Charles Kingston Welch of England patented, in addition to an air tube of rubber, a cover of rubber and canvas having thickened edges through each of which ran a retaining wire form-

ing a complete circle, the wires lying in a metallic rim specially channeled. In 1892 an American patent for a like invention was granted to A. T. Brown and G. F. Stillman of Buffalo, New York. In 1889 and 1890 William Erskine Bartlett of England obtained patents covering the clincher principle of tire attachment. Instead of wires for holding the tire-cover in place, his cover was made with beaded edges which engaged the incurved flanges of a clincher rim, so that the inflation of the tire held the cover rigidly. In 1891 and 1892 the clincher type of tire was developed in the United States under patents granted Thomas B. Jeffery and was first introduced by the manufacturers of "Rambler" bicycles—the Gormully & Jeffery Manufacturing Company. At this time each bicycle firm offered a special type of tire with the wheel it manufactured; and, as both wheel and tire construction were in their infancy, lack of standardization often interfered with sales. So it came about that in 1892 the G. & J. Tire Company was formed for the manufacture of tires exclusively.

In 1892 the single tube tire had become one of the most popular types for bicycles in America, and it was at the old and diminutive plant of The Hartford Rubber Works Company, of Hartford that the first single tube tire was made—using bed ticking for the fabric—under the patents taken out in this country by Pardon W. Tillinghast and introduced by Colonel Albert A. Pope on the "Columbia" bicycles. In 1893 the first thread fabric, or "cord," tires were patented in the United States and England by John F. Palmer. This tire came into prominence more especially as automobile racing was developed, but the principle has now been successfully applied to tires for all classes of work. Since 1891–1892, when

air was discovered to be the lightest, most resilient and cheapest filler for a tire, hundreds of other ideas have been patented. None, however, has proved to be as efficient as air. Neither have any designs equalled the simple constructions of Thomas B. Jeffery and Dr. Dunlop. The processes employed in the manufacture of tires, however, have steadily developed. At first, tires were all hand-built, but gradually tire-building machinery has been introduced, though at no time has the process become entirely mechanical. Among the latest developments in processes is the "Hopkinson Flat Band Ply," which has proved to be one of the most rational and highly efficient methods of tire building yet devised. This method was developed by the United States Rubber Company at its Hartford plant.

Rubber itself is the product of the milky juices found in the bark of many trees, shrubs and vines. The principal rubber-producing zone encircles the globe in the equatorial region—from thirty degrees north latitude to thirty degrees south latitude—in a moist, warm climate, the temperature of which ranges from 80 degrees to 110 degrees Fahrenheit, with an average yearly rainfall of eighty inches. South America alone formerly produced the best grade and the most abundant supply, known as "Para" rubber. African rubbers are obtained principally on the tropical coast of western Africa from a species of rubber vines which are climbing plants from four to six inches in diameter. Ceylon, or "Plantation" rubber, under cultivation in Ceylon, Java, Malay and Sumatra, is the result of forty years' tedious work and development. It was first imported to Ceylon in 1873 and is rapidly becoming the standard rubber of the world.

American rubber manufacturers have been forehanded in acquiring sources of the product. About fifteen years ago the United States Rubber Company, with its important Connecticut connections, began the cultivation of rubber in the Far East, and today the company owns and operates approximately one hundred and seventy-two square miles of rubber plantations in Sumatra and the Malay Peninsula.

TEXTILES AND ALLIED INDUSTRIES

WHILE Connecticut has ultimately developed into a preponderantly metal-trade State, its textile interests are by no means insignificant. Indeed, this branch of industry reached a stage approximating the modern factory system earlier than any other. While Connecticut has achieved distinction in only two departments of this branch, silk and thread, its interests in other lines are large and important. We shall see how the cotton industry has overflowed from its Rhode Island source into Windham and New London Counties, how woolen manufacture has centered in Tolland County, and how the knit goods and corset industries have assumed large proportions in Hartford County, Winsted, Bridgeport and New Haven.

Silk

It is curious to remember with what a struggle the hope for great oriental riches to be found in the new world died. The dreams of the early explorers of gold, precious stones, spices and silks recurred, even in the stern New England settlements. It is told in another chapter how the younger Winthrop carefully searched Massachusetts and Connecticut for metals. Only one of these early dreams came true—and that in a way quite remote from the early vision. Silk may indeed be found in Connecticut in gorgeous array, not from caravans but in busy modern mills. The largest and most complete silk manufactory in the world is located in South Manchester and other silk plants are found in the textile centers of the State.

To understand the glamour of early silk making, it must be recalled that, although the luxurious fabric

has been made in China, the home of painstaking artistic effort, from time immemorial, silk in Europe was of great rarity and extravagance until the seventeenth century. Indeed until 500 A. D. the very source of silk was a mystery, the secret of the silkworm being jealously guarded by the Chinese, and scholars variously guessed it to be a plant-born fabric like cotton, the bark of a tree, and the product of a large spider. Eventually, however, the intricacies of silkworm and mulberry tree culture were learned and silk was made in Italy, France and England by the seventeenth century.

Considering the value of the silk and the climate of the new settlement, it is not surprising that the British Crown made every effort to foster the industry in Virginia and the early Southern Colonies. In fact, James I tried to compel the planters of Virginia to abandon the cultivation of tobacco for the silkworm and mulberry tree in order to supply raw silk for the English factories. In 1623 Virginia planters were fined 100 pounds if they did not cultivate at least ten mulberry trees for each 100 acres of their estates. Generous bounties were also offered by the Virginia Assembly. In Georgia free land was offered to settlers who would plant 100 mulberry trees for each 10 acres, and instructors were sent to teach the Colonists. Although the Georgia efforts were more successful than those in Virginia and a filature for reeling silk from cocoons was actually built in Savannah, this attempt, too, failed. Through this artificial stimulation, Charles II, was crowned (1661) in robe and hose of Virginia silk, but tobacco and cotton production, not calling for the infinite patience of silk reeling, proved more profitable, and business inevitably followed the line of least resistance.

The first Northern silk was apparently made in Connecticut. According to some accounts Governor Leete, who died in 1683, raised his own worms and trees and had a suit made for himself of the product. Other reports fail to mention Governor Leete's Connecticut-grown silk suit, but give the credit to Governor Jonathan Law, claiming that on his farm in Cheshire in 1732 he made the first successful effort to raise silkworms, and that in 1747 he appeared in public in the first coat and hose of Connecticut silk, his daughter having spun the silk, later making herself a dress of the same fabric of Cheshire origin. Whichever of the two accounts may be correct, certain it is that establishment of silk culture on a more permanent basis is largely due to the efforts of Nathaniel Aspinwall of Mansfield and President Stiles of Yale in the mid-eighteenth century. Dr. Aspinwall introduced from Long Island, where he had a nursery, the wild mulberry tree, planting large orchards in Mansfield and New Haven. In this connection Bishop says:

"His efforts were effectual in rendering it a permanent and valuable industry in Mansfield. Mr. William Hanks of that town, according to the 'New London Gazette' of 1768, raised the previous year sufficient silk for three dress patterns. He and a number of other gentlemen in Windham County had large vineyards and nurseries of mulberry trees which had been cultivated 'to bring on a silk manufactory.' The card of Mr. Hanks offered for sale 3,000 trees which would be 'sold cheap for the speedy promotion of the cultivation of silk.' The Reverend Jared Eliot of Killingworth, one of the correspondents of the Society of Arts in London, states in his 'Essays on Silk Growing and Field Hus-

bandry in New England' (1760) that a principal cultivator of silk, of credibility, informed him he could make a yard of silk as cheap as he could a yard of linen cloth, of eight run to the pound; and that it was then considered *more profitable than any other ordinary business.*" The interest of President Stiles bore fruit in articles on the subject, the original manuscripts of which are now in the possession of the University. At a Yale commencement of that period, the entire academic procession was clad in silk gowns of Connecticut production and fabrication. The success of these two pioneers in localizing a promising silk culture in the original towns of Mansfield and New Haven, received approbation from the General Assembly, which assisted by offering in 1783 a bounty of 10 shillings for every one hundred white mulberry trees planted and 3 shillings for every ounce of raw silk procured.

It should be understood that this early industry was limited to production of raw silk, that is, the raising of silk-worms from eggs, the growing of the mulberry trees on whose leaves the worms feed, and the manufacture of raw threads by a tedious process of unreeling the threads from cocoons. Owing to the Crown policy opposing Colonial manufacturing of any sort, the silk in hanks was then sent to England to be woven. Weaving in Connecticut generally represented occasional efforts of rich housewives to gratify their pride in their art. With the ending of the British rule, however, the Parliamentary restrictions ceased, and by 1788 thirty-two individuals had petitioned the General Assembly to incorporate for the manufacturing of silk thread, and up to the time of the Civil War practically all of the silk

manufacturing in the State was of thread rather than fabric.

The contribution of the town of Mansfield to the silk industry is noteworthy. One Colonel Elderkin of that town, inspired by Dr. Aspinwall, set out a mulberry orchard in Windham and produced 10,000 pounds of silk a year, which was used largely to make the long silk hose worn by the gentlemen of the day. He also made a few handkerchief and vest silks and some dresses for his daughter. On the death of Elderkin, the property was sold to Rodney and Horatio Hanks, and the brothers built in 1810 the first actual silk mill on the continent. They also attempted to utilize steam power in the winding of sewing silk, but success was not attained until after 1820. During the entire early nineteenth century Mansfield, Windham and nearby villages were entirely devoted to silk culture, and the industry was ruined only by the mulberry speculation in 1837 to 1840. In 1825 it was reported that three-fourths of the families thereabouts were engaged in raising cocoons, or reeling and winding silk. The work, as is the case in all textiles, was done largely by women, often in their own homes, using the common foot-treadle spinning wheel. Silk "sewings," as this product was called, passed as currency in the vicinity, much as tobacco did in Virginia, being accepted at the village stores and elsewhere, silver being given in change, when needed to strike a balance. In 1829 the Mansfield Silk Company was chartered and machinery designed by Edmund Golding, who knew the European models, was installed.

The Northampton, Massachusetts, silk manufacturing originated in Mansfield, Captain Joseph Conant of that town forming the Northampton firm of Conant

& Smith. Mr. Atwood, of Atwood & Crane, also learned and practiced the silk manufacturing in Mansfield. This was the first successful manufacture of sewing silk by machinery. This company, too, was ruined by the mulberry "bubble," but those interested in it continued to carry on silk manufacturing in other connections. The prosperity of the Mansfield industry, which was diffused throughout the community and often yielded as much as five hundred pounds sterling per family per annum, turned the attention of the entire State upon the County, and in time attracted national notice. Indeed the Committee on Agriculture of Congress requested a report on the possibility of the culture of the mulberry tree throughout the country. This report, made the following year (1832), was to the effect that the culture could be successfully undertaken practically anywhere in the United States. It went on to assert that one acre of mulberry trees would sustain enough silkworms to make 120 pounds of silk, to the value of $640, a far greater return than that of any other New England crop. The "reeling" was described as easy and the machinery was asserted to be less expensive than for cotton or wool manufacturing.

This optimistic report, coupled with the discovery of a hitherto unknown kind of mulberry tree called the *morus multicaulis* of great superiority, lead to the astonishing "silk bubble" or "morus multicaulis speculation," which raged through the United States from about 1823 to 1840 and all but wrecked the entire industry. The new variety of mulberry, introduced into the country from China by way of the Philippines and France, was of much more rapid growth than the Italian mulberry and had much larger leaves. The Cheney family,

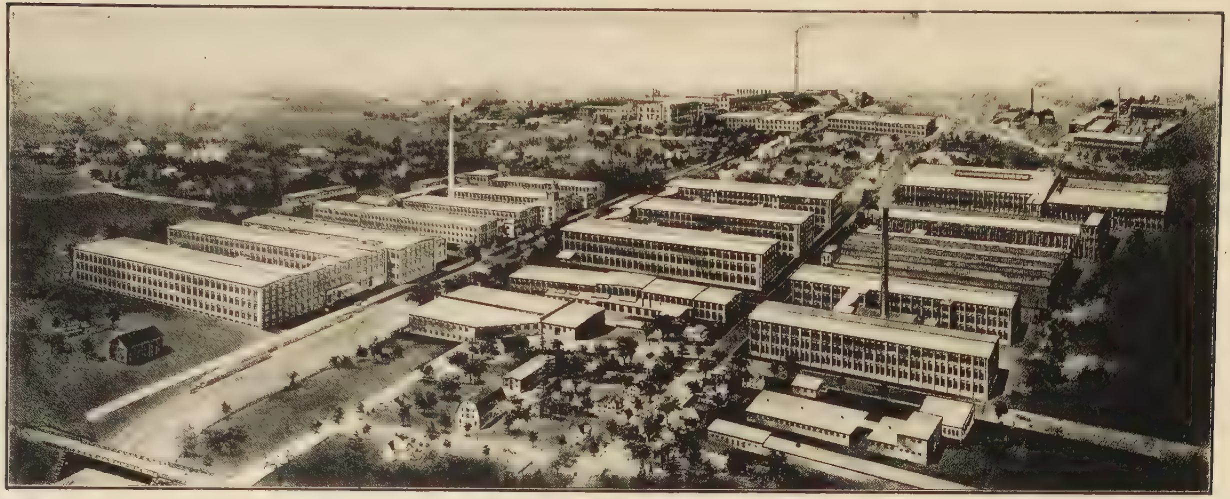
which was already experimenting with silk culture, possess family diaries and notes of the period giving a vivid picture of the period of speculation. In 1834 the new trees could be bought for as low as $4 a hundred; but with the frenzied popularity of the new industry, single trees by 1839 were sold for $1 or $2 apiece, or from $300 to $500 a hundred. In 1836 a Norwegian bark left Marseilles with 70,000 of the precious trees, all but 15,000 of which were consigned to Cheney Brothers in South Manchester, and notice was given that no more shipments could be made until autumn. In May of that year Ward Cheney laid three hundred of the trees horizontally, six inches deep in the ground, from which 3,700 shoots were grown. The leaves were ready for use in less than six weeks and were feeding 6,000 silkworms, which produced three bushels of cocoons. By August first the shoots were two and one-half feet high. In Monmouth, New Jersey, a grower made a profit of $3,000 in a short time from an investment of $400.

With the news of such possibilities in a new field, it is not surprising that the speculation continued wildly, in spite of the panic of 1837. But no industry is independent of economic conditions. The panic was desperate through the country, and at the same time growers began to realize that the morus multicaulis was not hardy enough for the northern climate. Even more important, it was found that Americans had not the patience and skill necessary for the laborious reeling from the cocoons, a process by which to this day the thread of the silk worm is unwound by hand from the water-soaked cocoon by tedious Oriental labor. By 1840 the collapse was complete. Nurserymen were left with great quantities of the expensive trees and no

market. Importers could not even pay freight charges on their shipments from abroad. The trees were sold for pea brush or burned. The entire silk industry bore tremendous losses and many companies were bankrupt, for even the manufacturers had abandoned their industry for mulberry culture under the lure of enormous profits.

As if this political and economic disaster was not enough, another catastrophe followed immediately, which was beyond the power of man to prevent or control. In 1844 a fatal blight attacked the trees, causing the loss of multitudes of silkworms and driving almost all of the remaining plantations out of existence. Even in Mansfield where the culture had been most prosperous, it was completely and permanently abandoned. Yet, disastrous as this period was to the silk interests, it had a far-reaching effect for good. It permanently eliminated silk culture, which could never have thriven under high-priced American labor, and transferred capital and business ability to the manufacture of raw silk imported from the Orient. Of this the remaining history of silk making in Connecticut has to tell.

Reference has been made to the Cheneys. The huge concern bearing their name, which in its line enjoys the position of leadership in this country, had its beginnings after this modest fashion. In 1830, Ralph, Ward, Rush and Frank Cheney, together with E. H. Arnold, formed the Mt. Nebo silk mills at South Manchester, the first really successful silk manufactory in the United States, and the only one that has existed continuously since that date. At first the Cheney Brothers had been interested in silk culture and their experience in the multicaulis speculation has been recounted. With the rest of the



Mills of Cheney Brothers, Silk Manufacturers, South Manchester, Conn,

silk growers, they took their losses; but, unlike most of the Connecticut growers, with the failure of silk culture they transferred their attention to silk manufacturing. With a capital stock of $50,000 this little group of pioneers made plans to convert a barn into their first silk mill, and in April, 1838, machinery was ordered for installation in the proposed plant. The barn idea, however, not proving feasible, it was decided to build a factory with ground dimensions of 32 by 35 feet. It is interesting to note that the hand hewing of the timbers cost 4 cents a foot and that the cost of the joiner's work for the whole original mill was $262. When this work was done the entire neighborhood turned out for an old-fashioned "barn raising bee."

The power for the factory was taken from the bottom of the tailrace of a mill which served at different times for paper making, grist grinding and distilling. A little undershot wheel was used and there was altogether only a six-foot fall. When the mill above was not running, the water supply was shut off from the silk factory. The first machinery inaugurated an important improvement, the principle of which is essential to working silk. This was the so-called "Rixford Roller" for doubling and twisting the thread, which was turned only by friction and hence would "give" a little in drawing out the silk, and thus avoid breaking it, as the former fixed rollers had been constantly doing.

The first energies of the company were devoted chiefly to the production of sewing silk, which was made almost entirely from raw silk imported from the Orient. The American merchant marine was then at the height of its glory and the famous clipper ships were making their marvellous runs from the Far East, "around the

Cape" in 90 to 100 days. New express liners now land their raw silk on the west coast of the country in from 11 to 14 days, whence they are rushed by fast freight direct to Connecticut, the total time from Yokohama sometimes being as low as 20 days. The early colors were few and crude as compared with modern products, as at this period the vast array of varicolored fabrics were unknown and only natural dyes were used.

With the far-reaching invention of the sewing machine, the demand for sewing silk was enormously increased as well as for a stronger and more even thread than that which had been called for in hand sewing. The Cheneys early manufactured a machine twist. About the middle of the century, also, the company created an entirely new branch of the silk industry in this country. Hitherto the greater part of the cocoons from which the silk moths had prematurely emerged had been wasted. There was also great waste from the raw silk, which became too tangled to be reeled. Attempts had been made to spin it, as was done with cotton and wool, but without notable success—although silk had been crudely spun in Europe. The Cheneys, however, after costly experimentation with cotton machinery, adapted it to silk spinning and made possible the utilization of a great waste product.

The manufacture of ribbons, originally undertaken in Hartford, but later moved to the parent mills in South Manchester, was added; and, as the company grew, "broad silks"—that is, silk by the yard—and silks of other varieties were added. At the present time, products from the most delicate flowered chiffons to the most gorgeous folds of regal velvet, and from the narrowest ribbon to the widest brocades, are being woven

in the group of factories which have grown from the little thread mill under the distillery. The Cheney Mills are the largest in the world and are the only concern in any country to carry silk manufacturing through all its different processes, from the raw silk to the finished goods.

Of interest to silk manufacturers will be some mention of important mechanical contributions made by this great company. Of these, the first, "the Rixford roller," has been referred to. In 1847 Frank Cheney patented the first practical machine for making sewing silk. The success of the machine in doubling, twisting and winding depended largely upon the use of "live," or moving, spindles mounted upon a carriage which ran back and forth on tracks in the second story of the mill. The third contribution was the utilization of the waste silk. In the Fifties an improved spooling machine was invented, and in 1882 was invented the "Grant reel," which throughout the world has been considered the most important labor saving machine for the handling of thread, not only in silk but in cotton and worsted winding, that has been developed. This machine eliminated the difficulty and waste caused by the snarling in skeins of silk. From the beginning, this great organization has remained in the hands of the Cheney family exclusively. Technical skill has been drawn to the mills unstintingly, but the actual control has never been held by any interests except those bearing the Cheney name.

The Brainard & Armstrong Company with mills at New London and Norwich dates from 1867, when a partnership was formed by Benjamin A. Armstrong and James P. Brainard for the manufacture and sale of spool silks. Both had had long experience in the sale of silks,

and desired to manufacture their own brand. For some years growth was slow. In 1879 there were about 17 employees and the little company rented power and space from a wood-turning shop on the New London wharf line. In the Eighties, however, the company began to grow more rapidly and specialized in embroidery silks, as well as in its original output of sewing silk. In this connection it patented the first washable colored embroidery silk. It owes much of its later success to its valuable discovery of silk dyes that would remain "fast color" when washed in hot water—a property no embroidery silk had boasted up to that time. Later the company also devised a further improvement in embroidery threads which employed an ingenious method of putting the embroidery silks in paper holders in such a manner that no unwinding and rewinding of skeins was necessary. In the old-fashioned skein not only time but much thread was wasted by snarling and handling. In 1888 the company interested itself in "broad silks" and has at the present time over 600 looms devoted to this branch of the business. It has now over 1,000 operatives in its several factories. In 1922 the Brainard & Armstrong interests consolidated with the Nonotuck Silk Company and the well-known Corticelli Silk Company, located at Florence, Leeds and Haydenville, Massachusetts. All took the Corticelli name. Since this consolidation, further factory space and machinery have been added. It will be noted that Connecticut may claim paternity for the great silk mills of Northampton and vicinity.

The manufacturing of silk was introduced into Rockville in 1857 by E. K. Rose. He met with little success, but his enterprise attracted the attention of the Belding

Brothers, whose activities in the silk world are well known. They had mills and agencies through New England and the Middle West, and entered into a partnership with the Rose Company, from which the founder himself shortly withdrew. For some time thereafter the mill lay idle, but as the Belding Brothers expanded it was started again in 1870. From the Rockville plant were established as outgrowths the large works of the concern at Northampton, Massachusetts, and subsequently those in Montreal and San Francisco. The Rockville factories manufactured sewing silk and twist exclusively.

In 1872 the mills employed in the early manufacture of sewing silk in Mansfield by Captain Conant (1829) were started again by O. S. Chaffee & Company, and continued to make silk mohair braids and silk lines thereafter. A few years previously, the Holland Silk Company had been established in Willimantic by two brothers, J. H. and G. Holland, the company continuing to the present time in the manufacture of spool silk and embroidery twist. Also in Willimantic are two mills of the Rossie Velvet Company; the Windham Silk Company, manufacturers of broad silks; and a branch of the Atwood Machine Company, for the manufacture of silk machinery. The Windham Silk Company is a newer concern making silk dress goods and trimmings.

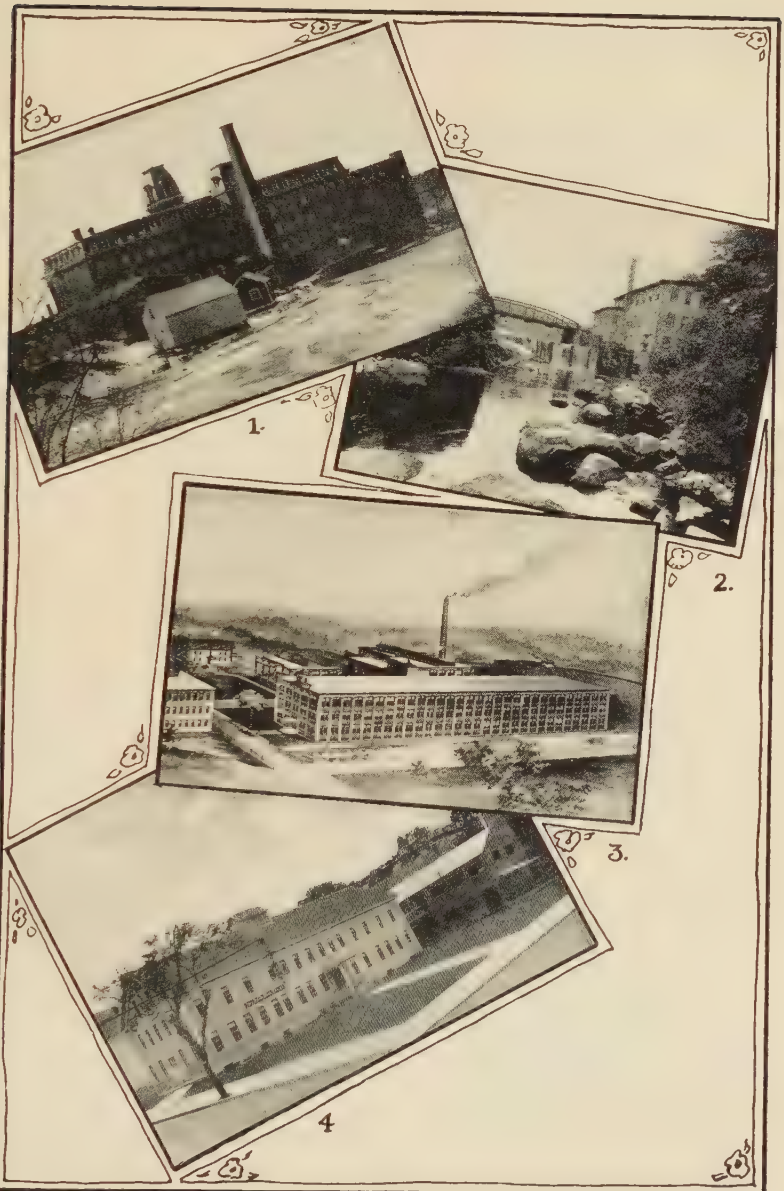
There are scattered silk manufacturing plants up and down the Connecticut River. The Warehouse Point Silk Company at Warehouse Point was established in 1874 as the Leonard Silk Company and manufactures silk thread. The Portland Silk Company of Middletown manufactures broad silks. In East Hampton, the center of the bell and fish-line industries which are men-

tioned in their appropriate chapter, is the Bevin, Wilcox Line Company, makers of silk fish lines. This product is also manufactured in Rockville by the Horton Manufacturing Company. The Bevin Wilcox Company is a subsidiary of the Bevin Brothers Manufacturing Company, who have been bell manufacturers in the town since 1832. The H. K. H. Silk Company is a very large producer of silks and has mills located at Watertown, Putnam, New London and Woodbury, as well as at Haverstraw, New York. This company has an interesting history, although not dating back to the formative period of the industry. Recently the name of the concern was changed to the Hemenway Silk Company. The Shelton Looms, now owned by Sidney Blumenthal & Co., Inc., located at Shelton, have been manufacturing silks for over a half century. In recent years this factory has become famous for its velvets and plushes. Mohair, silk and cotton upholstery pile are also manufactured here.

Cotton and Flax

The textile industry in Connecticut, as elsewhere, was the last to outgrow the household stage. Accustomed for centuries to the spinning of cloth in the home, even for many years after the invention of suitable machinery, the housewives continued to spin and weave in their kitchens. Cotton, a comparatively new product, brought from the South, was first to be taken over by the mills; the home-grown wool and flax remaining a fire-side product for years later.

The cloth made in the Colonies before the Revolution was almost entirely of stout coarse fabrics such as "fustian and linsey woolsey"—linen and hemp fibres. The cotton was brought largely from the Barbadoes and even

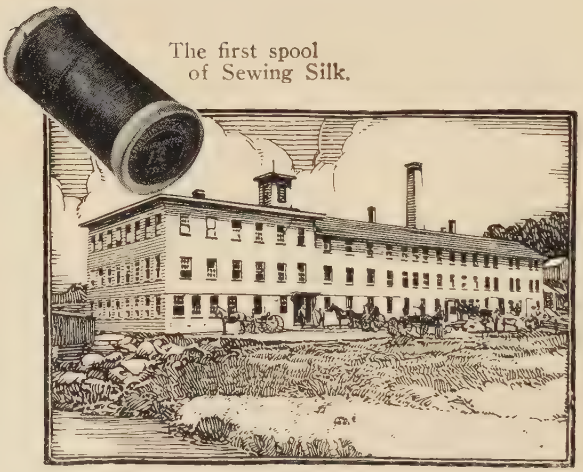


The four Silk Plants of the Heminway Silk Company in Connecticut

1. Putnam
2. Woodbury
3. Watertown
4. New London

Throwing process in one of the five modern mills of The Heminway Silk Company

The first spool of Sewing Silk.



Original Mill of M. Heminway & Sons Silk Co. at Watertown, Conn., where Sewing Silk was first spooled.

Smyrna. The well-to-do wore little of domestic manufacture, importing their silks, velvets and broadcloth. This was, of course, due to the self-centered British policy of discouraging Colonial industries of all sorts, not only by forbidding the erection of mills in the Colonies but also by keeping all mechanics and machinery in England by means of a heavy fine for attempted exportation and emigration. Equally destructive to British interests, this mistaken Crown policy had the same effect upon the textile industry as it had upon the metal trades; that is, to foster a skill and self-reliance among the colonists themselves. They soon became a people proficient in mechanical ability, and, from necessity, of inventive genius. The Colonials instead of purchasing their machinery from England, as they would naturally have done since England at that time was far advanced beyond any other nation in the development of machinery, built their own mills and manufactured their own machinery.

The first cloth manufactured in the Colonies was apparently made in 1641, in Massachusetts, the necessity of making at least their common clothing themselves being early recognized by the pioneers. At about the same time the General Court of Connecticut ordered each family in its province to sow a certain amount of hemp and flax, and before the Revolution both Connecticut and Massachusetts were making a surplus of homespun fabrics (household-made, of course), which were for the most part sent to the Middle States in exchange for provisions. As early as 1644 inspectors were appointed for each town to determine the remuneration of weavers of linen and woolen yarn.

Cotton weaving, too, was immediately made secure,

for the earliest mention of shipbuilding in Connecticut, in 1640, was the resolution of the General Court to build and send forth a vessel to secure "commodities to sett upon and attempt a trade in cotton woll, necessary for the comfortable support of these plantations." This was done, Governor Edward Hopkins sending out the vessel and apportioning its return cargo of "cotton woll" among the towns, Hartford being recorded as receiving its quota to the value of $200, Windsor $90, and Wethersfield $110. The cargo was paid for in corn and pipe staves.

The coming of the Scotch-Irish from Londonderry, expert linen weavers all, to New Hampshire gave a valuable impetus to improved textile production, and by the 1750's the threatening difficulties with England stimulated government support. In Boston the excise on carriages was revived in 1753 to support a free spinning school and a society was formed to promote the industry, setting forth as its principal object the encouragement of the manufacture of linen, and pointing out that Connecticut was yearly exporting flax to the value of £80,000 which could well be manufactured in Massachusetts. The Massachusetts General Court voted £1,500 to aid this undertaking.

President Washington's diary of his trip through New England in 1789 mentions with astonishment the use of machinery in a factory in Boston for the manufacture of duck. "There are 28 looms at work, 14 girls spinning with both hands (the flax being fastened to the waist). Children turn the wheels for them."

During the high feeling engendered by the Stamp Act and other trade controversies, "spinning bees" were held on village greens throughout New England and

government bounties offered for home-made cloth. At this period the yarn for woolen goods was woven by a hand-loom, and the web colored by home-made dyes or bleached for white. Certain itinerants made regular rounds through the country vending woolen dyes and colors—usually limited to brown, blue or black. Designs were sometimes stamped by them upon the home-woven linens, and this was called "sprigging." Linen was then ready for use, but wool must still be carded, oiled, rolled, spun and woven from the dyed yarn. Sometimes all of this was done on the farms, but the cloth was clumsy and shapeless and in most settlements there sprung up "fulling mills," which removed the oil from the woven woolens, and shrunk and pressed them into form. "Linsey-woolsey" was a popular fabric for the poor, having a warp of linen with wool filling—hence the name.

After Whitney's invention of the cotton gin and the inventions of Hargreaves and Arkwright for carding and spinning, the mills continued for a long time to give out yarn to individuals who wove it on hand looms in the homes. But the invention of the power loom eventually ended this mode of carrying on the industry. Cotton cloth was winning large favor in England and much attention had been given by British manufacturers to the new product. Accordingly, Abell Buell, that picturesque inventive genius so frequently mentioned, visited England at the end of the Revolution for the purpose of studying their manufacture of cotton cloth. Upon his return, he took as a partner a Scotchman named McIntosh and they set up the first cotton factory in America. However, this initial attempt was doomed to fail shortly afterwards. It was not until 1794 that there was a suc-

cessful cotton factory established in the Colonies, it being that of Samuel Pitkin & Company of Manchester. Around the close of the eighteenth century, cotton mills had become established in New Haven, Bethlehem, Suffield, Vernon and Norwich. The last mentioned, conducted by one Dr. Joshua Lathrop, was a more pretentious enterprise, boasting five jennies, one carding machine and six looms. However, the machinery must have been of crude construction.

The real development of textile industry on a large scale in the United States hinged upon the inventive genius of two men: Eli Whitney and Samuel Slater. The first great step was taken by Whitney in the invention of his famous cotton gin. Cotton had been grown in the South for years, but its commercial development was prevented by the presence of the innumerable little black seeds in the cotton bolls. The only known method of disposing of these was by hand, a painfully slow process, generally carried on by slaves. In spite of this, an American ship in 1784 carried to Liverpool eight bags of cotton and was seized immediately, upon the grounds that so much cleaned cotton could not be the produce of the United States. But in 1792 Whitney's invention revolutionized cotton production. This is a well-known story, chronicled briefly in every school history, but inasmuch as Whitney was one of Connecticut's most famous sons, it may bear repetition in this connection.

Whitney at the age of fifteen started a little nail manufacturing enterprise, carried on during the Revolution when these articles were in great demand, and brought a high price, later adding knife blades and pins to his products. By this means he paid for his education at

Yale College and in 1792 set out for Georgia to take a position as tutor in the family of a wealthy planter there. Arriving at his destination and finding the position already filled, he was stranded, penniless, a thousand miles from home. On his journey he had met the widow of General Nathaniel Greene, of Savannah, and learning of his predicament she invited him to make his home under her hospitable roof while studying law. There he met Phineas Miller, manager of the estate, and heard considerable discussion of the problem of removing seeds from cotton and the far-reaching and profitable possibilities of cotton culture, if the problem could be solved. Whitney had displayed his mechanical ability in various ways and Mrs. Greene made the remark at a gathering of cotton growers that she believed he could invent a machine to do the work. Encouraged by Miller, Whitney dropped his law studies and directed his attention in earnest to the subject, working in the cellar of the Greene house with such tools as he could find or make, and drawing his own wire. He is said to have made his first model in two weeks, and his machine became an immediate success. Its three essentials, the rotary wheel with forward pointing wires or teeth, the slotted bar, and the revolving brushes for cleaning the teeth are still in use.

The machine was indiscreetly exhibited to some visitors. The news spread through the plantations like wild fire, and growers came in crowds to view the miracle. Carried away by the possibilities of prosperity which it held out, the planters, although after the first indiscretion denied the inspection of the gin until patent rights could be established, broke into the little shed where it was housed and carried it away. Before

it could be recovered, a large number of gins were made using his principle with slight evasive changes. This catastrophe involved Whitney and his patron Phineas Miller in more than sixty law suits which consumed the entire profit of the invention, although making millions of dollars for the South. It is comforting to realize that Whitney eventually made a fortune in his arms manufacturing. By 1800, in contrast with the eight bags of cotton of 1784, 2,000,000 pounds of cotton was grown in the United States, and by 1805 that amount had doubled, and the supply of cotton for manufacture was definitely established.

Samuel Slater had been overseer of machinery for the inventor of the Arkwright machine in England and, although but twenty years old when he left the country for America, had enjoyed the advantage of studying the best machines of the period. Being a young mechanic of promise and learning of the need for his skill, the absence of competition, and the government efforts to foster manufactories in America, he left his home in Derby, England in 1789, disguised as a rustic and kept his destination a secret from even his family until he arrived in the New World. He was, of course, unable to take with him patterns or models. Arrived in New York, he went first to Philadelphia, but when he learned of the already successful little factory of Moses Brown in Providence he wrote the latter offering to reproduce for him the Arkwright machinery. He received a liberal offer from Brown and at once set to work building, with his own hands for the most part, not only the machinery but even the tools to make the machinery. In spite of his lack of patterns and workmen, by 1793 he was ready to operate a water-power textile mill. Slater

had been living in the family of Oziel Wilkinson and later married one of Wilkinson's daughters. Wilkinson was of equal fame with Brown as a pioneer in textile manufacture, both of them contributing enormously to the textile and machine tool progress of New England. Wilkinson's other three daughters married Timothy Green, William Wilkinson, and Hezekiah Howe, all names known to the textile world, and in 1799 Wilkinson and his gifted sons-in-law started a second mill. By 1815 there were 140 cotton manufactories within 30 miles of Providence, employing 26,000 hands and operating 130,000 spindles.

This thriving textile industry in Rhode Island, attracted by the bountiful water power, soon over-flowed into Connecticut, which had always been a spinning state, not only of domestic cloth but also of canvas for sails, owing to the amount of shipbuilding within its borders. Richard Rogers of New London, as early as 1724, had petitioned the Assembly for the exclusive right to make canvas for sails. In 1775 Nathaniel Niles of Norwich had "a manufactory" of iron wire for cards, which was continued through the Revolution on a state loan, because of the importance of textiles at that time for the clothing and tents for the soldiers, whose early suffering from lack of these essentials during the war is well known.

As early as 1806, Oziel Wilkinson established a cotton mill in eastern Connecticut at Pomfret, putting his brother-in-law, Smith Wilkinson, in charge as agent. The frame building was completed on July Fourth and a celebration held in honor of the event, at which "over 2,000 were present and free punch served to all!" From then until about 1812 there was a frenzy of cotton

mill building, particularly in that part of the State:—In Jewett City, named for Eleazer Jewett, pioneer manufacturer, the Jewett City Manufacturing Company, in 1811; the Sterling Manufacturing Company in 1808, which within 10 years had 1,600 spindles; at Plainfield, the Union Manufacturing Company, Andrus Factory Company, and Central Manufacturing Company (later the Kirk Mills); in Thompson, the Thompson Manufacturing Company, later the Masonville Company and still later incorporated with William Grosvenor and others as the Grosvenordale Company; together with many others long since abandoned. Small wonder that, in view of the fact that few had even dreamed of such an industry a few years before, the "Windham Herald" in 1811 asked its readers in an apprehensive editorial, "Are not the people running cotton-mill mad?"

Apparently the madness was justified, for, in spite of the manufacturing slump after the War of 1812, in 1818 there were 22 mills in Windham County and, from the number of people engaged and the value of their product, textile manufacture was second only to agriculture and served to check the growing emigration westward by offering lucrative employment at home. As for the rest of the State, in Hartford County there were 13, of which only three were of importance—the Hartford Manufacturing Company, the Marlborough Manufacturing Company, makers of blue cotton slave cloth, and a Glastonbury mill. In New Haven County there were two sizeable mills at Humphreysville and New Haven. In New London County were nine small mills and, scattered through the rest of the State, perhaps 25 others of like character.

The first mill at Pomfret was the most ambitious of

these enterprises. With adequate financial resources and keen managerial ability, it introduced an innovation of vast importance to manufacturers. At that time the factory system of production was still a novelty, without organization or form. In England and Continental Europe the conditions near factories were appalling. Children not yet in their teens were employed for long hours, the drunken parents exploiting mill children, frequently living entirely on their wages. Crime and insobriety were rampant in this new prosperity of the poor, and it is not surprising that many of the conservative well-to-do element earnestly protested against the installation of such a system in America, in place of the thrifty self-sufficient household industries. The Pomfret Manufacturing Company, however, determined that factory conditions here need not be like those in the Old World. A thousand acres of land was purchased, lying in Pomfret, Thompson and Killingly, to provide farm land, and thus employment, for the parents of the children employed in the mill! Taverns were excluded from the district and a school and church erected.

During this early era of prosperity, new machinery was continually being developed. David Wilkinson of Pawtucket improved a cheap power loom which enabled the small as well as the large manufacturers to dispense with hand looms. They soon disappeared entirely from factory use, although remaining in the homes for many years. Machinery was still about 50 per cent to 60 per cent more expensive in America than in England. Cotton remained the predominant manufacture in Connecticut through the middle of the nineteenth century, and in 1850 there were 128 establishments with a joint capitalization of about $4,250,000. Of these, many have, in

spite of changes of name and management, survived to the present time, and continue to abide in their original locations in Windham County and Norwich.

In connection with the 1850 statistics just quoted, the subject of wages is of interest. The 6,185 cotton operatives listed for Connecticut received monthly wages of $82,743—an average wage of $15 a month. As the same statistics indicate an average monthly wage of nearly $30 a month for employees in the metal industries, the obvious answer was extensive use of female and child labor. This is borne out by figures in "Dwight's History of Connecticut" (1841), in which he quotes the wages of the cotton industry for 1831 at $5.22 per week for males, $2.20 per week for females, and of children under ten, the greater proportion of the employees, $1.50 per week. This condition, of course, corrected itself and school laws were passed providing for the education of children engaged in industry. Textiles have always employed more female and child labor than other manufacturing establishments, the work being light and clean.

To narrate the individual history of all of the companies which contributed to the development of the cotton industry in Connecticut would go far beyond the space allotted to this volume. There are, however, certain concerns which must be mentioned because of the part they played in the development of their industry. The Quinebaug Company of Danielson is located on the site of one of the earliest of the Windham County cotton mills. In 1807 General Danielson and Zodac and James Spalding secured the consent of the Assembly to build a dam for a mill at Queinebaug Falls, the dam being necessary because salmon ran up the stream to

spawn! The rights were transferred to Comfort & Ebenezer Tiffany (the former of whom was the father of the founder of Tiffany & Company, the famous New York jewelers), and by them the mill was built. The present name was given to the company when the Tiffany family sold the factory to a group of Rhode Island manufacturers in 1848. The company is now capitalized for $1,000,000, covers nine acres of floor space and operates 61,340 spindles and 1,656 looms. It produces white, fancy, and colored shirtings, pongees, and pillow tubings. During the war it manufactured over 100,000 yards of gauze for surgical dressings, weekly.

In Jewett City, the early Jewett City Manufacturing Company paved the way for the great Ashland Cotton Company with its capitalization of $1,250,000 and the Aspinook Company and Jewett City Textile Novelty Company, the two last being engaged in dying, bleaching and printing the woven cloth, and the first making cotton sateens. The several mills early started in Plainville later became the Kirk Mills, now the Lawton Mills Corporation, capitalized for $2,000,000.

In Willimantic the pioneer cotton spinner was Percy Richmond, 1822. Within five years, there were four mills, the largest of which were the Windham and Smithville Manufacturing Company (originally W. & J. Hayden), now combined as the Quidnick-Windham Manufacturing Company. This corporation is combined with mills at Quidnick, Rhode Island, and controlled by Rhode Island interests. Willimantic textile interests were early diverted to thread manufacturing by the success in that line of the Willimantic Linen Company, originally engaged in the manufacture of cloth.

The Attawaugan Company has great mills in Windham County dating back to the Stone Chapel Manufacturing Company. It has plants at Killingly (Attawaugan), at Bozrahville, and at Montville. At the Montville mills are made the Pequot sheetings and domestic cottons known to every housewife under this trade name.

Other large cotton mills in Windham County are the well-known Wauregan Mills, at Wauregan, manufacturing lawns and fancy cotton goods; Aldrich Brothers of Moosup, a $3,000,000 concern controlled in Rhode Island; and at Putnam, several large cotton manufacturers, including three mills of the Nightingale-Morse Mills, Inc. and the Putnam Manufacturing Company. The Connecticut Mills Company, with two mills in Danielson, the Manhasset Manufacturing Company in Putnam and the Goodyear Cotton Mills, Inc. at Goodyear are all engaged in the manufacture of tire cloth for the automobile industry. In Tolland County, although this is a woolen center, are the Eagleville Company, and the two mills of Paul Ackerly at Vernon. The former was originally a woolen mill, established about 1850.

New London County, particularly Norwich, early attracted the textile manufacturers in the eastern part of the State on account of its fine water power. Norwich, it will be remembered was the location of the ambitious enterprise of Lathrop, before Slater's time. Slater, himself, was not successful in securing water-rights there, although he attempted to secure one at Norwich Falls. The Falls Company has come from the little mill of William Williams, Jr. & Company, which began the manufacture of cotton cloth in 1813

on the Yantic River. The Shetucket Company and the Falls Company both manufacture heavier textiles such as denims, awning cloth, ticking, etc.; and it is for this grade of goods that Norwich textile manufacturing companies are particularly distinguished.

Nearby are the Ponemah Mills of Taftville, among the largest cotton manufacturers in the country. The promoters of the Occum Company were instrumental in calling the attention of Cyrus and Edward P. Taft to the facilities of the location in 1865. At Occum are two Totokett Mills, manufacturing cotton shirtings, occupying a privilege dating from 1866. At Bozrahville the Gilman Brothers Company is the only manufacturer of cotton felt in the State—coming here in 1893 and buying out the Bozrahville Company.

Centering in Norwich is the United States Finishing Company, a concern for the bleaching, dyeing and finishing of cotton goods, begun in 1840 by Moses Pierce, who established a small mill for bleaching goods as the Norwich Bleaching & Calendaring Company. The organization enlarged its operations steadily, adding a department for the printing of colors on cloth by means of engraved copper rolls. It has since merged with Rhode Island interests and acquired the Sterling Dyeing & Finishing Company, of Sterling, Connecticut, and has become the United States Finishing Company. It has six plants, those at Norwich and Sterling being the only ones in Connecticut—although the Norwich mill is the largest of the six. In Voluntown are the mills of the Briggs Manufacturing Company and at Baltic, the Baltic Mills Company.

Side by side with the cotton industry, has developed the manufacture of twine. One of these companies

leads back to the name of an early promoter of the cotton industry, that of Oliver Chace. One of the most important pioneers in the twine industry, however, was William E. Nichols, who, about 1830, built a twenty-spindle twisting machine at Moodus, Connecticut, hired his power from a nearby sheeting mill and commenced the twisting of yarn into twine. His father was a dry goods peddler and young Nichols employed him to introduce cotton to the fishermen along the Connecticut shore. The fishermen were at first in doubt as to the durability of the new twine, but gradually adopted its use. About 1866 he organized the New York Net and Twine Company at Moodus and commenced the manufacture of netting by machinery. About 1830 Stanton S. Cord came to Moodus from Sterling, Connecticut and engaged in the business of wagon making. He was attracted to the twine industry by observing the prosperity of Nichols. Having an opportunity to purchase a saw mill located on the Moodus River, he transformed it into a factory for manufacturing seine twine. This venture proved successful, and in 1842 he bought another water power site on the Moodus River and started a second factory. This developed into the present Neptune Twine & Cord Company. Another twine manufacturing company dates to 1814, in what is now Westport. It was the Saugatuck Manufacturing Company, manufacturing cotton and woolen goods, later called the Richmondville Manufacturing Company. It is now the Lees Manufacturing Company and produces mostly cotton twine.

Woolens

Paralleling the manufacture of cotton products in Connecticut was the development of the woolen in-

dustry. Although this never has assumed the proportions of the cotton industry, it has, nevertheless, been an important factor. To turn back 150 years, we find the main source of woolen fabrics in the household industries, there being but few scattered woolen mills in the Colonies as early as 1700. However, in Lord Carnbury's Report on the state of the Province of New York in 1705, which had such influence in moulding the anti-industrial policy of the British Crown toward the American Colonies, he warns his government "I am well informed that upon Long Island (then part of Connecticut) and in Connecticut they are settling upon a woolen manufacture." The Stamp Act had its usual effect of stimulating this industry. The non-importation societies provided articles for its protection in the form of urging butchers and consumers to refuse mutton, in order that the entire wool supply might be preserved for industrial purposes.

The first woolen factory of which there is actual record is that of Gabriel Harris of New London, who willed four looms and a silk loom to his heirs before 1700. But the first enterprise of the sort of any size was the woolen mill of Colonel Jeremiah Wadsworth at Hartford, which received legislative assistance, was known throughout the Colonies, and made 5,000 yards of broadcloth in the year 1788 to 1789. It was the ability of the mill to turn out a good grade of broadcloth that attracted public attention, for that apparel of the gentry had heretofore been imported. General Washington's diary mentions his visit to this factory where was made, "broadcloth of good, although not the first quality." He ordered broadcloth for a suit for himself, however, and an entire piece of "ever-

lasting" for servants' breeches. He is said to have taken his oath of office the next January in a full suit of Hartford broadcloth presented by the manufacturers; and it is reported that not only the President, but the Vice-President and all the Connecticut Senators and Representatives wore suits of Wadsworth broadcloth. The enterprise was short lived, however, and in 1795 ceased to exist.

The real difficulty in the successful establishment of woolen mills was the lack of good wool for the high-grade materials which had always been imported. This was first solved by General David Humphreys of Derby in 1810. General Humphreys had been, during the Revolution, one of Washington's aides and was after the war appointed by him Minister to Spain. While there he sent home to his farm a flock of 100 fine Merino sheep, and on his return had woven high-grade woolens of their shearing. These he displayed at fairs and other public gatherings to demonstrate the value of improved sheep and encourage their culture. The reception of these samples led Humphreys to establish a factory on a mill privilege on the Naugatuck River, at what is now Seymour. Owing to his residence abroad he, too, determined to eliminate the evils of the European factory system and near his factory built a school house and three churches, together with housing facilities and gardens. He was also instrumental in securing the passage through the Connecticut Legislature of a bill providing for "town visitors," empowered to enforce moral and physical care of employees, the fore-runners of the present department of factory inspection.

The Republican (Democratic) party in 1810 called for the support of the new woolen industry on patriotic

grounds, and proclaimed with characteristic resounding phraseology that "American manhood must be freed from the necessity of foreign livery"! Jefferson wrote that he understood that Humphreys made the best cloth of the times and, ordering a suit for himself, concluded with the phrase, "Since homespun is the spirit of the times." Madison, too, was inaugurated in a suit of Humphrey's broadcloth.

The Humphreysville Manufacturing Company was incorporated in 1810, and by 1812, and for a period thereafter, was the best equipped woolen mill in the United States, turning out fine broadcloth considered equal to the imported product, sold at $4.50 a yard. It had 150 employees, a huge plant for that time. It is described in "Dwight's Travels" as having as equipment "four breakers and finishing cards, two jennies, a billy with forty spindles, a picker, four fulling mills, two shearing machines, four broad looms, eight narrow looms, and eighteen stocking frames."

Humphreys must divide honors as "father of the American woolen industry" with Arthur and John Scholfield, who came from England with Slater, from Yorkshire, their only capital being the plans for the new textile machinery which they carried in their heads. They first went to Massachusetts, but later leased a water privilege in what is now Montville, the site of John Winthrop's saw mill in 1653, known later as "Old Forge." They improved the shop and put in operation the first woolen machinery in Connecticut operated by water power. Arthur went to Pittsfield but John, until his death in 1820, remained in the same vicinity, where he purchased or built several other mills, one being on the site of the Joseph Otis cloth mill of 1790.

There he made "Scholfield Satinet," a business continued by his descendants for many years.

The origin of "satinet" in Connecticut is of interest. In 1811 Peter Dobson erected a cotton mill at Vernon. The war offered him his opportunity of making material for uniforms. He was shown a piece of cloth from a tailor's bench, and, examining it closely, saw that the warp was of cotton and the filling woolen yarn. He thereupon made a "jack and jenny" for spinning wool, having seen a similar machine in England. In a short time he was turning out satinet in quantity, mixed blue for soldiers uniforms, and later in other colors for the trade.

The success of Humphreys and Scholfield, coupled with Humphrey's valuable activities in promoting improvement of sheep in this country and the approach of the War of 1812, which shut off all importation, lead to a wool boom in Connecticut, as in the rest of the country. The importation of merino sheep was encouraged in every way and local "Merino Societies" were founded which held exhibitions, offered premiums, and published treatises. By 1812, the quantity of wool, especially that of good quality, had been doubled, and Coxe in his Report on the subject stated, "no country probably ever witnessed so rapid a change in the extent and quality of its flocks as the years 1800 to 1812 have effected." New companies sprang up everywhere. Machinery was improved and, in the year 1812, of the 237 patents issued a large proportion had to do with textile machinery, especially looms.

In rapid succession in Connecticut were organized the Middletown Manufacturing Company of Isaac Sanford, said by some to have been the first to use steam

for manufacturing purposes; a mill at Wolcottville, of which Governor Wolcott was the principal owner, later the Torrington Manufacturing Company, and Waterville Knitting Company; two mills at Goshen; one at Mystic; and in Vernon what later became the Hockanum Mills. By 1815 there were 14 woolen factories in New London County; in Litchfield 8 woolen mills, 4 cotton mills, 50 carding machines, and 40 fulling mills; in Hartford County 9 woolen mills and 37 fulling mills; New Haven County, 5 woolen mills and 29 fulling mills and clothier's works; in Windham, although a cotton center, 10 small mills; in Middlesex 5 factories and 17 fulling mills; in Tolland 11 fulling mills. Thus there were 60 factories, nearly all new and most of them small, only 5 being estimated as using over 10,000 pounds of raw wool a year.

At the height of the prosperity of the woolen manufacture, when foreign competition was entirely cut off by the war, broadcloth from these mills was selling from $8 to $12 a yard, later reaching $18 a yard. Although there were general charges of extortion on the part of the public, there was much reason for these prices. Wool and indigo tripled in price and labor was at a premium, owing to the runs being all at full capacity and new mills forming constantly. The entire situation was too abnormal to continue long. The cessation of the war, the flooding of the country with foreign woolens—it must be confessed that the English broadcloth was superior to the American—and the removal of protection lead to wholesale bankruptcy of the war-born mills. They were ill-equipped to meet such a crisis, much less the nation-wide panic which followed.

The State government and various industrial societies,

formed for the purpose, did what they could to alleviate the situation. When the General Assembly convened in May, 1817, the members, four-fifths of them clad in domestic woolens in spite of the lower prices of foreign goods, exempted the cotton and woolen factories of the State from taxation for the succeeding four years, and their employees from poll taxes and militia service. There was, however, no adequate federal protection of the textiles for about 15 years, and few of the early mills survived the interlude. The failure of the Woolen Bill of 1827 led to a frantic effort on the part of all friends of the industry. A memorial, couched in the strongest terms, from thirteen New England and Middle States was presented to the next Congress, and in 1828 the tariff gave the textile manufacturers their first adequate protection since the war. The woolen and cotton mills were again started up, and by the outbreak of the Civil War there were 93 woolen mills in the State, that number including hosiery, carpet and felt manufacturers. The 1850 statistics give the capital of Connecticut invested in the woolen industry as nearly $4,000,000 with about 5,500 operatives whose monthly wage averaged somewhat under $20.

The woolen manufacture of Connecticut centers today in Tolland County at Rockville, although there is considerable production of this class in the other textile centers; for woolen manufacturing, like cotton, followed originally the good water privileges and where it first located it has for the most part remained. Tolland is the smallest county in the State and, of its thirty odd factories, all but three or four are either textile manufactories or devoted to the production of textile acces-

sories, such as cards, supplies, or buttons for the woolen knitted wear. Of this overwhelming proportion of textiles, twenty-five are woolen mills.

The pioneer in this woolen center was Elisha Pitkin, who in 1770 established on a water privilege on the Hockanum River, the first wool carding machine in the State to be run by water power, under a patent for making "cloth without yarn." By some this is claimed to be the first water-power mill in the country. Other mills soon followed: the Rock Manufacturing Company established by Colonel Francis McLean in 1824; the Frank Company; the Leeds Company, an off-shoot of the Rock Manufacturing Company; and the New England Mills, beginning in 1837 as the first Rockville mill to manufacture fancy cassimeres, a higher grade product. These and other mills were for the most part combined with the Hockanum Mills or the American Mills Manufacturing Company, the former of which is capitalized for $6,000,000, the latter for over $1,000,000. The Springville Manufacturing Company stands on the site of an early woolen mill established in 1819.

Stafford Springs and Staffordville are also important woolen towns, the Cyril Johnson Woolen Company and the two mills of the Fabyan Woolen Company being the largest in point of capitalization. Stafford early manifested an interest in wool, for in 1721 the town offered a bounty of six pence per head for sheep brought within its limits, although its eighteenth century and Revolutionary fame had been based on its metal industries, owing to its possession of iron ore. When the metal supply was exhausted the town again turned to textiles. The earliest mills were for the manufacture of cotton, and between 1840 and 1850 the satinet manu-

facture of Eliot A. Converse flourished. But the woolen industry from Rockville superseded it. The Cyril Johnson Woolen Manufacturing Company was organized in 1888 by Cyril Johnson, manufacturer of "Tivoli Kerseys," and Alexander I. Mitchell, present owners of the mill. It manufactured cassimeres. During the World War the company was diverted to the production of uniform cloth for the Army and overcoating for the Navy but has since returned to the production of men's suitings and overcoat material. Among other manufacturers of wool cloth or knitted wear, there are the Phoenix Woolen Company, organized in 1858 as a fifteen-loom mill making men's suits; the Stafford Worsted Company; and the Warren Woolen Company.

At Talcottville, in the town of Vernon, Talcott Brothers have been manufacturing union cassimeres since the Civil War. At Somersville is the manufacturing company of the same name. More than half of the Tolland County woolen mills are knitting mills for underwear.

It will be remembered that one of the earliest woolen mills was at Middletown, where a fine broadcloth factory was established by Isaac Sanford and others before 1812. It was run by a pioneer steam engine, 24 horse power. Except for some twine and silk manufacturers, textiles have disappeared from Middlesex County with the exception of the Rockfall Woolen Company manufacturers of horse blankets, camp blankets and steamer rugs. But further up the Connecticut River the industry has been more tenacious. At South Glastonbury is the Glazier Manufacturing Company, owner of the Hopewell Mills, tracing its history to the Nayaug Manufacturing Company, established in 1837. It manufac-

tures woolen fabrics, and employs about 200 persons. At Windsor Locks is the J. R. Montgomery Company, the largest of the Hartford County woolen companies, employing between 450 and 500 hands. This concern was established in 1871 to manufacture satinets and cotton cassimeres, but some years later it interested itself in the production of novelty yarns and this branch of the business has since become its chief product. "Novelty yarns" are those used to decorate women's garments and other trimmings. The Montgomery Company is practically the only concern in the country making metal or tinsel threads for the same purpose, having developed its own machinery for this line. With the outbreak of the World War these threads were greatly in demand for telephone and switchboard cords and for wireless and other communication purposes. The shutting off of the German supply, and the French manufacturers being absorbed in war material, left the great bulk of the Allied demand to this Windsor Locks factory.

Returning to New London and Windham Counties, scattered among the cotton textiles are also many large woolen mills. The American Woolen Company, that great Massachusetts woolen corporation owning more than 50 mills in New England and the South, has bought two mills in Norwich, and two in Moosup, where woolens and worsteds are manufactured; also the Whitestone Mills at Elmville (near Norwich) where dyeing and finishing is done. About 800 people are employed at these various plants. At Baltic are the two plants of the Shetucket Worsted Mill with 125 employees; and at East Lyme the Niantic Manufacturing Company, established in 1832 as a cotton mill, but run

as such for only two or three years, when it was converted into a woolen mill. At Hanover there are the Airlie Mills. In Norwich the Joseph Hall & Son and the Saxton Woolen Company are the largest woolen manufacturers, the latter being capitalized for a quarter of a million dollars.

The largest of the Windham County woolen mills is probably the Putnam Woolen Company. The other larger mills include the Central Worsted Company and Farnsworth-Pinney Company of Central Village; Assawaga Company, Inc. of Dayville; Killingly Worsted Company and French River Textile Company at Mechanicsville; Perrys Mills (controlled in Webster, Massachusetts); and Waterman Worsted Company, Putnam. Except in Tolland County, the Connecticut woolen mills are smaller than the cotton mills, the above mentioned companies, except where otherwise stated, averaging about $100,000 capitalization and 100 to 125 employees, with an annual turnover of from $750,000 to $1,000,000 a year.

Scattered woolen manufactories occur elsewhere throughout the State, for the most part survivors of earlier mills built during the "wool boom." The Wolcottville Company, started by Governor Wolcott, survived various changes of management and was the predecessor of the present Warrenton Woolen Company of Torrington. Elisha Pitkin's felt enterprise in Rockville leaves two felt manufacturers in the State, the Charles W. House & Sons of Unionville and the Lounsbury and Bissell Company of Norwalk. The House Company was founded by the original manufacturer of woven felt whose first mill was in New Jersey —Charles W. House. A later mill was established in

The Lounsbury & Bissell Company, Felts.—Norwalk, Conn.

Glenville, Connecticut, but the enterprise is entirely in Unionville now. This company, like the Montgomery Company of Windsor Locks, makes a textile product otherwise not produced, except abroad. One result of this advantage was the production during the War of over a million little felt washers of a peculiar composition for the timing-fuses of bombs. Its specifications were painfully exact, since the washers must burn through only at the stated rate of speed, in order to set off the explosion accurately.

Knit Goods

In 1845, Clark Bissell and John Lounsbury formed a partnership for the manufacture of wool felts at Norwalk. Wool felts were manufactured until 1881 when the manufacture of hair felts was added. The successive presidents of the concern have been S. B. S. Bissell, C. C. Betts, Louis C. Green and Henry W. Gregory. The felts manufactured by the Lounsbury & Bissell Company are used for many purposes, one of the most important of which is for gun wads which the firm has been manufacturing for about thirty years. The wool felts are used for boot-linings, shoe pads, shoe felts, for machine washers and various other things.

Knitted woolens and hosiery deserve a special mention, as differentiated from the manufacture of woolen cloth. In this line Connecticut has always been prominent. During the Colonial period the records of the General Assembly contain many requests for government loans to start hosiery manufacturing and stocking-loom manufacturing. Although these were consistently refused, there were stocking-looms in Connecticut before the Revolution, notably those of Christopher Lef-

fingwell at Norwich, where eight looms were employed manufacturing hosiery exclusively. By the beginning of the nineteenth century, there were well-known looms in Colchester and Meriden, as well.

Although the knitting machine and stocking frames had been in use over a century, it is natural that the knitting of stockings should have remained a household industry longer than any other, even in the textile field. But in 1831, Timothy Bailey of Albany applied power to the stocking frame successfully, although previous efforts to do so in England had failed, and it was many years before power-weaving was introduced into England from this country. By the new process, a girl, paid about $2.50 a week, could knit a piece twenty-eight inches wide and one inch long in a minute, or twenty pairs of drawers a day; whereas, by hand, two pairs was a full days work. The stocking frame, which, operated by hand power, turned out twelve pairs of hose a week, could, when run by power, turn out 200 dozen pairs. This machine, of course, gradually eliminated knitting as a commercial household industry.

The largest knitting company in Connecticut is the American Hosiery Company of New Britain. This Company was established in 1869 by John B. Talcott, who was the first president of the concern, and a number of others whose names are prominent in the history of Connecticut manufacturing of that period—Stanley, Russell, Judd, Jewell, Cooley and others. Unlike most of the older Connecticut manufacturing concerns, it did not grow from a small enterprise but was started by a stock capitalization of $200,000 and later increased to $3,000,000, owing to the era of high prices immediately following the Civil War when much of the

machinery had to be imported from Europe and paid for in gold, at a premium of from 40 per cent to 60 per cent. The company was one of the first to manufacture a very high grade of knitted articles of a sort previously imported. An idea of the growth of the company may be had from the fact that the first price-list and catalogue offered less than 20 "lines" of underwear and hosiery, whereas at present there are about 500.

Another old Hartford County concern, established in 1855, is the Glastonbury Knitting Company, which has been engaged in the production of men's underwear from its foundation. It produces a wool and merino flat-knit garment, both two-piece and union suits. The Medlicott Company of Windsor Locks, established in 1868, is also a well-known manufacturer of men's underwear. The Dunham Mills, Inc. of Poquonock and Naugatuck has likewise established lines of knitwear of recognized standing. It is another of Connecticut's concerns in which family control and direction have persisted and remained efficient.

The Winona Mills Company of New Haven dates from 1890 when its parent concern, the Columbia Hosiery Company, was founded. This company was one of the pioneers in the "direct sales" idea. Owing to executive difficulties between the hosiery and underwear branches of the company and other causes, this company has had financial difficulties, but it has recently reorganized and started a period of expansion. The N. L. Birge Sons Company of Norwich, dating from 1850, are also well-established manufacturers of knit underwear.

The Winsted textiles date from the venture of two

Rockville brothers in 1813. This was not successful, but woolen manufactories followed it, of which the two largest are the Winsted Hosiery Company and the New England Knitting Company, both controlled by the same management. Together they employ between 700 and 800 persons and have an annual business of $2,500,000. The companies have another branch at Norfolk—which is the parent company. It was originally the Norfolk-New Brunswick Hosiery Company, one of whose superintendents went to Winsted and interested local capital in knitting mills.

Although of somewhat differing character, an account will also be given in this chapter of several other products for which Connecticut is known industrially and which may be more appropriately grouped under the general heading "textiles" than any other.

Thread

Connecticut may claim the entire credit for the successful production on a large scale in this country of thread. It was in Rhode Island, however, that cotton was first used in the manufacture of sewing thread. Flax had been the sole material previously, but as Mrs. Samuel Slater, wife of the founder of cotton textiles in America, was spinning cotton, she noticed the firmness of the fibre and suggested to her husband that it might make a smooth thread. It will be remembered that Slater had married one of the daughters of Oziel Wilkinson, and it is not strange that she should have displayed practical textile ideas of her own. This early cotton thread was unbleached and undressed and of the coarser sort, since the long-fibre Sea Island and Egyptian cottons now used in spinning fine thread were then

almost unknown. The thread was sold in skeins, which were not so inconvenient in that period of universal hand-sewing as they would now be considered. But a certain amount of loss from tangling was inevitable, and it was not long before the thread was sold on spools. By some accounts this innovation came from New Hampshire and by others it was inaugurated in Elisha Brandegee's little cotton-thread factory in Berlin, Connecticut. Of course, the thread was not wound as smoothly and perfectly as it is today, but the spool was a great improvement.

For many years all the domestic thread continued to be of the coarse unbleached variety, and there was thus built up a feminine prejudice against any varieties made in this country, even after a better-grade was being manufactured. So widespread was this feeling that, until the success of the Willimantic product, many thread-manufacturers in the United States resorted to the subterfuge of stamping and packing their product as if for a voyage across the Atlantic, putting it in soldered leaden boxes as did the English manufacturers to protect it from dampness during its journey. The processes invented and perfected by the Willimantic Linen Company in Willimantic, changed this situation entirely. The company was organized in 1854 the Austin Dunham with several partners, for the manufacture of linens, such as crash towelling, napkins, and shoe thread. The failure of the supply of flax in that same year, during the Crimean War, forced them to seek another product and they began to manufacture coarse threads—"three cord No. 60," and coarser. Patient experimenting led the company to conclude that finer and better thread, too, might

be made in this country, and a successful six-cord thread was finally produced. The terms "through-cord" and "six-cord" refer to the combining and recombining (technically called "doubling") of the filaments of the cotton in a greatly attenuated form. The nicety of the combination and attenuation of the filaments is what distinguishes the finer cotton threads, and the filaments by the modern processes actually undergo this "doubling" millions of times. Another grave difficulty which the Willimantic Linen Company overcame was the handicap of climate. For years the English manufacturers had claimed that fine threads could not be made in this country, because a certain degree of dampness, essential to one of the processes, was lacking in the atmosphere. By the use of steam pipes and atomizers, now called humidifiers, the necessary atmospheric conditions were secured, and from that time thread as fine as "number 200" has been spun. The first step toward nationwide recognition of this Connecticut product was the highest award won by the Willimantic Linen Company threads at the Centennial Exposition (1876) in Philadelphia. This was followed by similar success at other expositions, and within a few years American thread was everywhere accepted and the Willimantic company was actually securing some export business.

The first building of the company was one erected in 1825, one of the first manufacturing plants in the town, and known as Jillson's cotton mill. New buildings were constantly called for by the growth of the business. During the Civil War a stone mill was built of material quarried on the spot and paid for out of war-time profits, and the company's capital thereby preserved intact. The mill added in 1880 was characterized at the time it was

built as "the model cotton mill of the world." The name of the company was changed to the Willimantic Thread Company and, in 1898, was combined with the American Thread Company. Another mill to enter the combination was the Merrick Thread Company of Holyoke, Massachusetts, which was formed originally by Timothy Merrick and Monroe Johnson, who had been previously associated with the Willimantic Linen Company. The Willimantic branch of the American Thread Company now comprises six mills, a bleach house, and a concrete warehouse. Formerly the spools were made in Willimantic, but as the local wood supply dwindled, the company erected a spool mill and formed a settlement called "Willimantic," in Maine. Since its amalgamation with the American Thread Company, the spools and cases used by the concern are made at other mills owned by that corporation in the same State.

Another company which has had a vital part in the success of American cotton thread making, and which antedates the Willimantic Company, is the Gardiner Hall, Jr. Company of West Willington, situated within a few miles of Willimantic. This company was organized in 1840 as The Willington Thread Company by several partners, one of whom was Origin Hall. A few years later Gardiner Hall, his brother, came to Willington and built a little mill for the manufacture of wadding. This venture was not a success and he joined the thread company. Gardiner Hall afterwards went to Willimantic to superintend the erection of the Linen Company mills, the other partners withdrew, and a son, Gardiner Hall, Jr. began in 1860 to manufacture thread alone. This was done in the face of the many discouragements to new ventures which existed in the un-

settled days just preceding the Civil War. His success in the manufacture of spool cotton was greatly augmented by his invention of several valuable machines. In 1861 he devised an important thread-dressing or thread-finishing machine. Shortly afterward, he invented an automatic spool-printing press, which was adopted by all thread manufacturers to print labels in two colors by one operation on thread spools. The one of greatest value and importance, however, was the tension regulator, which gives a constant tension and takes the thread off the spool evenly, easily, and without turning the spool. It is of interest to note that all the devices for rapid and perfect unwinding of thread from spools, in place of patient untangling and cutting of threads from loose skeins, seem to have been timed for the advent and general use of the sewing machine. Gardiner Hall, Jr. was later re-joined by his father, although the company name was unchanged. His son, William Henry Hall, carried on the business until his death in 1922, and the company still remains in the Hall family.

At East Hampton is the Franco American Thread Company where shoe threads are manufactured. This company was originally a branch or subsidiary to H. & L. Rogez of the ill-fated manufacturing city of Lille in France. During the German invasion its machinery was wrecked, and the French mills closed for lack of raw material. Since the World War the Rogez interests have merged with four others in France under the name Filatures et Filiteries de France and production has been resumed. The Connecticut branch specializes in the manufacture of shoe thread for sole-sewing purposes, made of flax and certain imported raw materials.

Corsets

Connecticut manufactures nearly three-fourths of the corsets produced in the United States; and Bridgeport, where a large percentage of the output exists, is the largest corset manufacturing center in the world. New Haven is the second corset manufacturing city in Connecticut.

The localization of this industry in Connecticut is due largely to the Warner Brothers Company of Bridgeport. In 1874 Dr. I. De Ver Warner and Dr. Lucien C. Warner, brothers and specialists in women's diseases, had made under their direction an improved form of corset waist, with straps over the shoulders and boned with reed. Up to this time there were few corsets made in the United States and many of them, as well as those imported, were so badly constructed as to injure the health of their wearers; and it was through studying the ill results of improper corseting that the Warner brothers were first moved to experiment with the designing of one which should be scientifically correct. The original "health corset," as it was named, was made of two thickness of cloth, with reed boning between. Later more modern "flexible corsets" were introduced.

The brothers formed a partnership and began to manufacture in McGrawville, New York, but with the growth of the business the company was moved in 1876 to Bridgeport, then the sewing machine center. The company has grown from a little enterprise in which $2500 was originally invested to a large concern with buildings covering four city blocks and a capital stock of $5,000,000. This company manufactures the "Redfern" corset and has introduced other popular types.

With the increasing scarcity and final disappearance of whalebone, the company perfected to take its place a rust-proof steel which is now used by practically all corset manufacturers. The La Resista Corset Company of Bridgeport is another large company, organized in 1901 as Downer, Hawes & Company. It is the originator of the "Spiralbone," a woven flexible corset stay, known to the trade. The company employs about 300 hands and manufactures approximately 300,000 pairs of corsets a year.

In New Haven the leading corset manufacturers are the Strouse Companies. Strouse, Adler & Company was originally J. H. Smith & Company, being purchased in 1861 by Isaac Strouse. It is, therefore, the oldest as well as one of the largest in the State, and manufactures and deals in all kinds of corset materials, as well as the finished product. Their "C/B a la Spirite" and "Regaliste" corsets are well-known corset trade names, the brands being marketed all over the world. The company constitutes one of the largest industries in New Haven, giving employment to between 1000 and 1500. The Clara Moore Corset Company, R. N. Bassett Company and Gilbert Corset Company, are well-known New Haven names in the corset trade. An idea of the extent of corset manufacturing in Bridgeport and New Haven may be had from the fact that there are twelve corset supply manufactories in each city. In South Norwalk are manufactured the popular "R & G" corsets.

Carpets

For many years the name of "Hartford" has been conspicuous in the carpet world. The domestic manufacture of carpets was one of the infant industries

especially cherished by Alexander Hamilton and his wisdom led to the establishment of mills of that class, so that by 1830 the production of floor-covering by the United States was equal to its needs. The earliest large manufacturer of carpeting was located in Philadelphia. In 1840 Erastus B. Bigelow of Boston invented a power loom to weave Brussels carpet, although the problem of weaving a two-ply web so as to produce any required pattern had been abandoned abroad as impossible of solution. Bigelow had previously invented a loom to weave coach lace and this machine was the basis for his greater triumph. In 1849 the Bigelow Carpet Company in Clinton, Massachusetts, was formed and within a few years was manufacturing 150,000 yards of Brussels carpeting a year.

Meantime carpets had long been made in Connecticut by the old methods. As early as 1827 a "manufactory of Ingrain or Kidderminster carpets and shawls was carried on at Tariffville, Connecticut, by an incorporated company, under the direction of H. K. Knight; some of its productions were considered elegant and four years after, it employed a capital of $123,000 and 95 male weavers." This flourishing company was succeeded by the Hartford Carpet Company, which, by the time of the Civil War had mills at Thompsonville and Tariffville, with a capitalization of $1,200,000 and machinery and capacity to produce annually 1,700,000 yards ingrain carpeting, 500,000 yards Venetian carpeting, 200,000 yards Brussels. In 1889 the Bigelow Carpet Company and Lowell Manufacturing Company, a company tracing its origin in carpet manufacture to 1825, consolidated as the Bigelow Carpet Company. Two years later, the Hartford Carpet Company and E. S.

Higgins Carpet Company, also manufacturers since 1837, merged as the Hartford Carpet Corporation of Connecticut. In 1914 a merger of all four of these large pioneer companies was effected and the present Bigelow-Hartford Carpet Company formed, its capital stock being $13,500,000.

Bed Comfortables

One of the largest manufacturers of bed comfortables in the country is located in New London, with mills in that city and in Montville and Fitchville. This is the Palmer Brothers Company. The cold winters of New England greatly increased the use of quilts and comfortables by the early colonists, and the "quilting bees" of our ancestors were widespread and very popular social diversions. Frequently the upper covering was composed of an immense number of small shaped blocks of cloth carefully sewed together into a patchwork pattern of surprising complexity and frequently of high artistic design. We are told that "To these designs quaint names were given, like the 'Rising Sun,' 'Log Cabin,' 'Job's Troubles,' 'Dove in the Window,' 'Crow's Foot,' 'Chinese Puzzle,' 'Sunflower,' etc. When the patchwork was completed, it was laid flatly on the lining with layers of wool or cotton wadding between, and the edges were basted all around. Four bars of wood about ten feet long, called the quilting-frame, were placed at the four edges, then the quilt was sewed to the edge with stout thread, the bars crossed and tied firmly at the corners and the whole raised on chairs or tables to a convenient height. Thus around the outstretched quilt a dozen quilters could sit running the quilt together with fanciful set designs of stitches. When about a foot on either

side was wholly quilted, it was rolled upon its bars and the work went on. In this manner the visible quilt diminished in a united and truly sociable work that required no special attention and in which all were facing together and drawing closer together as the afternoon passed in intimate gossip."

The increasing demand for such comfortables called for their manufacture in quantities and naturally led to attempts at the invention of labor saving machinery, whereby their production might become a commercial success. Several "quilting machines" were produced and patents granted upon their various devices, but from them no permanent economic advantages resulted. It so happened that it fell to members of The Palmer Brothers Company to discover and combine into workable machinery all of the basic principles and devices required to perfect the manufacture of these goods. The firm was founded at the close of the Civil War by Elisha L. and Edward A. Palmer with a capital of $2,000, which was derived from government pay accumulated to Captain Elisha Palmer's credit while he lay for eighteen months in Libby Prison. The business at first consisted of buying and selling cotton rope, twine and batts. In 1872 Frank L. Palmer was asked to fill an order for bed comforts from a Chicago customer. This order was supplied largely by hand work, turning out four a day. Neighboring housewives were induced to assist in this new departure, some ten thousand comfortables being made the first season at a remuneration to their workers of 25c each. In a few years a so-called "gang sewing machine" with about twenty needles, which had been abandoned by its unsuccessful inventor,

was purchased and, after infinite trouble, was adapted to quilt the cheap grades.

Crude machinery for quilting in parallel, curved or lozenge shaped figures was designed largely by Frank Palmer, and this was developed in 1884 into the "Palmer Quilting Machine" for universal pattern quilting. The basic principle of this machine, namely the movable gear or pinion engaged in a track in pattern form and guiding a movable sewing machine so as to reproduce the pattern upon the comfortable, was invented solely by him. This principle was finally developed into the present quilting machine by William H. Palmer, who at about this time was engaged to devote his inventive talent to the improving of the mechanical processes used in the business. For thirty years thereafter he worked in his chosen field producing many labor saving devices, chief of which was the "gang knotting machine." This machine, with almost uncanny accuracy, accomplishes, by an intricate series of cams, levers and mechanical appliances, the human action of tying knots with silk or worsted yarn, tacking the covers together, cutting the yarn into the proper lengths and counting the knots—in all, saving the labor of forty persons per machine.

Various other inventions and adaptations of machinery and a widely extending development of both cloths and fillings, especially prepared, have enabled this company to secure a very large proportion of the business in this line, and the production has so increased that what was a local handicraft has been lifted into the position of one of the recognized commercial industries of this country.

Principal Plant, Fitchville

Main Building and Tower (160x40 feet, four stories) built 1886; Extension (300x60 feet, three stories) with second tower completed 1912. Water power and steam, 1200 horse power

PLANTS OF THE PALMER BROTHERS COMPANY

New London Plant

Swansea Dye Works (Printing Division)
South Swansea, Mass.

Original Plant, 1866, Montville

Garments and Accessories

In Bridgeport, Stamford, and the Norwalks—as Connecticut approaches New York—are various manufacturers allied with the so-called "garment-trade," which is so largely associated with the metropolis. This manufacture of garments is carried on in Fairfield County rather extensively; and also the manufacture of various trimmings and specialties. Notable among the makers of the latter class of products is the American Fabric Company of Bridgeport. This company manufactures lace and trimmings, and is believed to have been the first in the State to make lace by machinery. In this company, contrary to the European practice, the entire process is completed in its own extensive shops. Thread is purchased from the spinners and bleached, dyed, and finished, and spun into laces and trimmings of various sorts. All designing is also done at the plant. At the European lace manufactories the different stages are performed by special companies, and the American Fabrics Company is undoubtedly the most complete machine-lace plant in the world. It provides employment for 1,000 persons.

In South Norwalk are several other lace and trimming manufactories, among which may be mentioned the Connecticut Lace Works, Inc., manufacturers of silk and cotton laces; American La Dentelle, Inc., manufacturers of Cluny laces; and J. & J. Cash, Inc., manufacturers of frillings and tape, and particularly of the woven labels on which are embroidered the name or number desired. The Cash woven labels were the first production of the sort and are now used by institutions and individuals for marking garments and linen. This

company has an unusual history. Organized in Coventry, England about 100 years ago as a ribbon manufactory, it was forced to other channels by the French treaty of 1871, which placed it at a disadvantage in silk manufacture. The company at first made frillings, and finally invented machinery, and produced "the personal name tape." In 1868, an agency was established in New York and in 1906 the first American factory was built at South Norwalk. An American company was incorporated and plants have been built elsewhere in the United States and in Canada. It is of interest to note that J. & J. Cash are credited with having used the first colored lithograph picture ever employed for advertising purposes—a radical and extravagant departure at that time. They also claim to have sent the first commercial cablegram across the Atlantic addressed to their New York agent and reading "Go to Chicago."

HATS

MUCH of the industrial activity of the thrifty and enterprising colonists was applied to the development of new articles of trade. There were other articles, however, such as hats, where the commodity had been in use for centuries.

It is difficult to ascertain when hats were first worn, nor is there any record as to when or where they were first manufactured. A modern hat,—that is, a head-covering distinguished from the cap or bonnet by the possession of a brim—can be traced back to the "Petasus" worn by the ancient Romans when on a journey, and hats with brims were used probably on like occasions by the earlier Greeks. It was not until after the Norman conquest in the eleventh century that the use of hats began in England. Charles the Twelfth, upon his triumphant entry into Rome in 1453, wore a huge hat made of fur, lined with red velvet, from which protruded a great feather.

About the middle of the seventeenth century an effort was made to encourage the making of hats in America. In 1662 the Assembly of Virginia passed a special enactment offering ten pounds of tobacco for every good wool or fur hat produced in that locality from material taken from native animals. Hats were then made by hand and no effort of any consequence was made to improve upon this primitive method until 1820, when the genius of an American inventor produced the first labor-saving machine for their manufacture. In 1849 the soft felt hat made its bow into the United States.

Hats were very generally made in the New England Colonies and were among the earliest of the manufac-

tured products of the new country to arouse the jealousy of British manufacturers and merchants. In 1731 the felt-makers of London complained to Parliament that the foreign markets were being supplied by hats from America, and hats were being sent even to England, to the great detriment of the English trade; they therefore petitioned to have the export of hats from America to foreign markets prohibited. In consequence of this petition a special committee was appointed to examine the subject, which reported that in New England and New York 10,000 hats were being manufactured yearly. A law was therefore passed in 1732 prohibiting "hats or felts, dyed or undyed, finished or unfinished" to be exported from a "British plantation" under penalty of a heavy fine (500 pounds). This law remained in force until the Revolution. But, as in the case of other Parliamentary restrictions on Colonial industries, the making of hats continued and increased and by 1800 was thriving in every state in the Union.

Connecticut did not early excel in the manufacture of hats, although an average number were made. The State failed to come into prominence in the industry until after the Revolution—the same period, 1790–1820, when many of the great industries had their beginnings. But while Connecticut was lacking in quantity of production, to her must be given the credit of actually making the first hats in America. It is generally conceded that the first hat produced on this side of the ocean was made at Danbury—and undoubtedly the abundance of little fur bearing animals, such as the beaver and muskrat, on the creek banks in the vicinity had much to do with the growth of the fur-hat industry there. Historical records give ground for the belief that among the original

eight families who trudged the many trails from South Norwalk and founded Danbury in 1684, one at least was a hatter. Little did they dream that they were founding the future hat center of the country; but, as surely as Pittsburgh means steel and Detroit automobiles, Danbury, although a city of only 25,000 population, means *hats* to the world at large.

The first actual manufacturing enterprise of this type appears to have been the little red shop of Zodac Benedict, now the site of the Danbury post office. During the Revolution, Benedict employed a journeyman hatter and two apprentices and turned out three hats a day. In 1787 Burr & White, or O. Burr & Company, carried on what was then an enormous hat trade, employing 30 hands and turning out hats at the rate of 15 dozen per week, 750 dozen per year. Soon after the Revolution other shops were built, and by 1800 hatting was definitely established as the chief occupation of the inhabitants of the town. In 1801 Danbury hat manufacturers produced more than 20,000 hats, mostly for exportation. Most of the hats at this time were heavy and unfinished and were sold for six dollars and ten dollars a piece at wholesale, to be finished later in South Norwalk or New York.

In Robbins' Century Sermon, delivered at Danbury, January first, 1801, we find this statement: "In the manufacture of hats this town much exceeds any one in the United States—more than twenty thousand hats, mostly of fur, are made annually for exportation." The first hat stores to be established in the South, in connection with manufacturing at Danbury, were in 1802, one being at Charleston, South Carolina, and the other at Savannah, Georgia. Trade records show that the

fashionable hat of the period was six inches deep with two inches brim.

By 1808–1809 there were fifty-six hat shops in operation in the Township of Danbury, averaging from three to five men each. Many farmers were interested in the trade, setting up a kettle and hiring journeymen. The Danbury shops were originally a small plank-room where the men gathered about a kettle, heated by a wood fire, and pulled and hauled the bodies of coarse fur with their own hands at the rate of one an hour. Gradually the shops increased their capacity, employing more men —the shops becoming fewer in number but larger, little factories taking the place of little shops. Beginning in 1820, with the invention of a machine for forming wool hat bodies, the history of hatting revolves about the development of new machinery, to a larger extent, perhaps, than in other lines, because hat making was a peculiarly laborious industry and the processes themselves unique.

In 1823 there appeared a man who was to become to Connecticut hatting, what Seth Thomas was to its clock making—a skilled workman with business ability to build up an organization which his descendants still carry on to increasing prosperity. Ezra Mallory was 38 years old, a farmer near Danbury, when he decided to abandon agriculture and manufacture the high beaver hat of the period. In a little shop a few rods from his dwelling he began with one hatter and an apprentice. He had to learn the trade himself, although he had all his life been a judge of furs as were all his neighbors owing to the demand from the already numerous hat shops in the town.

In those days a "beaver" hat was literally a hat made

of beaver or some other fur and was the dress headgear of all occasions, marking, with its tall bell-shaped crown and heavily rolled brim, the well dressed gentleman. Heavy and unwieldy as they were, they were cherished carefully. Since they were expensive, costing about ten dollars each, they passed frequently from father to son. Wealthy gentlemen mostly bought hats imported from England, but with the growth of the industry more fashionable "stove-pipes" came to be made in Danbury and marketed in New York and Boston and other centers of fashion. Small wonder, indeed, that they were expensive! They were made entirely by hand, and by a most difficult and peculiar process. The raw pelts were bought in the crudest state by the manufacturers, Ezra Mallory going sometimes as far as Canada to buy from the Indians bear, muskrat and otter skins. A very common source of skins for Danbury was the sand dunes of Coney Island, the famous resort having taken its name from the Coney rabbits which abounded there.

The fur was cut from the pelts with long-handled shears and the hair separated from the fur by patient fingers; for to a hatter "fur" means only the thick covering next to the skin and not the long hairs protruding beyond the soft mat. Then came a process calling for even more patient manipulation, called "bowing." This consisted of snapping the catgut string of a catgut bow time and time again against the pile of loose fur on a bench until it was freed from foreign substances and matted into what ultimately became the fur fabric of the hat. Then the bowed fur was fashioned into a large cone-shaped form and alternately dipped into boiling water and rolled again until it was shrunk and felted

into a cone-shaped body about one-quarter of the original size, which, ultimately, with skilled and laborious manipulation was fashioned into a hat. Finally the hats were distributed to women of the vicinity who plucked out the remaining hair, which after all these processes remained sticking in the nap, one by one by tweezers!

The original ledger of Ezra Mallory betrays in its quaint entries the pioneer conditions still surviving in the commonwealth a century ago. In 1823 Jedediah Jones is credited "By your old hat, $1.00." A grocer and shoemaker are each credited with provisions and shoes respectively "in part exchange for a hat." In the same year the Astors of New York received various credits for packets of furs. At that time beaver was bought for $4.75 a pound; today it commands about ten times that sum. The old ledger shows that Mallory bought for $2 apiece twelve sealskins which would be worth today $100 each.

"In Danbury a hundred years ago," according to a reliable account, "beaver 'plug' hats sold for eight dollars; plain hats for one dollar and fifty cents and upward. In 1825 James Woodward, an apprentice, was credited with services for two years and three months at $50 a year—$112.50. M. Benedict, another apprentice, evidently was boarded out at Mr. Mallory's expense, for the latter credited the landlady with $12 for a month's 'keep.' Another woman was credited with 'washing and mending, May first to December sixth—$10.' During this epoch, and indeed for twenty-five years following, workmen were paid mostly in orders on Danbury stores and Mr. Mallory accepted merchandise whenever necessary in settlement of accounts."

Plant of the Mallory Hat Co., Danbury, C

in upper left corner shows factory as it was in 1872

Like the clock maker and tin-maker, the hatter, when he had accumulated a small surplus stock of his product, would pack it upon his horse and ride out to sell it himself; but, whereas the former sold his wares through the surrounding territory, the better grade of hatmaker was more likely to ride to Norwalk with his product, and thence take or *send* it to New York, because, as the old advertisements claim, "saling vessels departed with reasonable certainty" for that port. The price of such a passage was fifty cents, the voyage taking about twenty-four hours. "Sometimes," continues the account, "the hat manufacturers chartered a special stage for New York and loaded it high with boxes of hats and rattled merrily down the Boston Post Road. There was a daily stage between New York and Boston, but it was too crowded for the hatters and their big boxes."

Hats were sold on credit and when the accounts were not settled by trading, collectors of cash were sent out. This was a calling of adventure and daring, considering the condition and loneliness of the roads. "On one particular occasion a Mallory collector was gone for many weeks and on his return, Mr. Mallory gave him a famous dinner, inviting a dozen men specially skilled in hat making. The hero recited his experiences and the money collected (practically all silver) was sorted in piles on the dinner table."

Ezra A. Mallory's son, who in 1838 had entered the business at the age of sixteen, brought to Danbury, whither the business had been moved, the first sewing machine used in the hatting business (1861). In so doing he aroused an antagonism which marked a new and prophetic stage in the business, the hat industry having been particularly sensitive to labor troubles through-

out its career. The women refused to use the innovation, but his sister-in-law came to the rescue and worked the machine in the face of insults and low humor. She was the wife of Samuel Mallory, who was associated with the factory for a short time.

The sewing machine was followed by mixing, blowing, and forming machines, and later by stretching, blocking and pouncing machines. Probably the most valuable acquisition was a hat-forming machine, suitable for fur hats, invented by one Wells, which eliminated forever the catgut bow—for years the peculiar symbol of the hat-makers' art. The invention was not generally used until somewhat later, but when finally established numerous improvements followed. Another new invention effected the coloring of hats by machinery, thus supplanting the former slow and tedious hand method. By the middle of the last century the new inventions had so increased production that a hat could be turned out every minute. In 1842 a convention of hat manufacturers held in New York appointed a committee to examine and report upon the introduction of machines for expediting the operations of the business. The committee reported that hats were then sold at an average of twenty-five to fifty per cent cheaper than ten years before, when labor was mostly manual. During the financial panic of 1837 the hat industry had been so depressed that the hatters worked on the highway for a dollar a day.

Twenty-five years later, during the Civil War period, the tall hat was sweeping the country and Danbury prospered in consequence. In 1859 sales of a million and a half dollars were made from Danbury hat factories, in-

volving 123,870 dozen fur and wool hats. Over a thousand hands were here employed in the industry at that period. The city began to make other types of hats also. It was in 1849 that Baron Kossuth introduced into America the soft felt hat, which, because of its comfort and novelty, became instantly popular. E. A. Mallory & Company took on the attributes of a modern industry when in 1856 it was incorporated by Ezra Mallory's Son, with a capital of $20,000. It was at that time manufacturing 8,640 dozen hats a year, employing ninety-five workers and making sales of $150,000. Improved machinery had been introduced, of the types described, each innovation bringing stormy labor protests—mostly short lived.

Among the more interesting of the early labor problems was that connected with the appearance of nap hats for women, which the Danbury manufacturers had begun to produce when bonnets went out of fashion for women, and formed hats were adopted. The gradual introduction of hat-making machinery had eliminated the older generation of hatters, and when Mallory decided to make the napped hats a new dilemma confronted him. These hats differed sufficiently from the ordinary product to render the machinery useless in their production. They could be constructed only by hand, which required a return to the old tedious processes. Mallory conducted a country-wide canvass for men who could "bow a hat," offering a bonus of $10 apiece. Thus it happened that many picturesque old-timers were rounded up. Some of them, supposing their life-work over, had retired altogether, and others were found in various pursuits elsewhere. When Mallory brought

them back, the tables were turned. They were the heroes of the hour, and they turned scornful eyes upon the machines that had displaced them.

This rejuvenation brought large rewards in wages. Secure in their fancied belief that their restoration was permanent, they refused to teach their art to apprentices. Meanwhile the demand for these hats had become clamorous, and soon inventive genius came to the rescue with new automatic machines; and suddenly the old-fashioned hatter found himself again minus his old-fashioned job. The first machines used by the factory in making naps are still preserved as curiosities at the plant. They turned out from thirty to forty dozen naps a day, while under the old hand-method a fast workman produced only a dozen and a half. The company expanded, new and improved machines were installed as hatting developed, the grandsons and great grandsons of the pioneer Mallory carrying on the business. It rounded out its hundred years by making extensive additions to its factory and now boasts the second largest "quality hat" business in the United States. The history of this concern has been given in some detail because it typifies the development of hatting, and is another of those old Connecticut concerns which have remained in the hands of the original family and risen to national prominence.

A brief description of the manufacture of the modern felt hat made from fur is entitled to a place in this history. The fur which Benedict and Mallory bought from the Indians in the form of raw pelts now comes mostly from abroad—beaver, nutria, muskrat, coney, and numerous varieties of hair from Russia, Australia, South America, Scotland and other countries. Great bales

H. McLachlan & Company, Danbury, Conn.
Manufacturers of Men's Felt Hats in the Rough

holding from two thousand to four thousand cured skins are brought to Danbury factories. The skins are shaken clean in huge drums, slit, trimmed, and de-haired. The top growth of hair must be taken out of the dense soft actual hair before the latter can be used for hats. Each animal yields about an ounce or two of real fur. The casual observer would never suspect that every fiber of these furs is set with many infinitesimal barbs or hooks. Before the furs go to the hat factory proper, these hooks are further developed by a chemical treatment, called "carroting," which alone makes possible the later felting, or making of the hat fabric. Delicate scales separate to a fraction of an ounce the quantity of fur for each hat. Next the fluffy stuff is taken to the Forming Room.

Here too is an industrial iconoclasm upon which the old hat makers would look with shocked sensibilities. Set on a platform along the room are the hat-forming machines, enclosed in wood and glass cabinets several feet high, having hinged doors. Each cabinet or box holds a removable copper cone, hollow and perforated with minute holes. The cone, having been removed at the end of the preceding operation, is moistened and replaced in the machine. It begins to turn when the door of the cabinet is shut, and underneath a rapidly-revolving fan creates a vacuum inside. On a high stool back of each cabinet a girl now feeds into it the fur for one hat at a time, and the flurry of fibres falls on the cone softly and evenly. Thus is there made a fabric without spinning or weaving! The barbs seize each other with a grip that, once the process is complete, never relaxes—though at first the felt is very fragile.

When the workman stops the machine and opens the

door, the cone wears the embryo hat—merely a limp and loosely-knitted "dunce cap" two-and-a-half feet high. The workman now takes out the cone. Working on a bench across a narrow aisle, he slips off the new fabric, which immediately begins its adventuresome journey through the plant. After a process or two, the freshly made fur fabrics reach a room where men wearing leather aprons stand at machines and dip the "dunce caps," four at a time, repeatedly into tanks of boiling water, rolling and kneading them, wrapped in cloths, between immersions. This heavily shrinks the still primitive hats, and after they have been through this process, they begin to bear the semblance of headgear. Many operations ensue, both mechanical and manual, among them one in which the felt fabric is literally "shaved;" then come treatments with various solutions, and pouncing machines which work with sandpaper. Finally, the shapes are blocked and ironed by machine, according to the style desired,—soft "velour" or stiff "Derby." Present operations have become marvels of mechanical ingenuity, although for hats of the better grade there is still a surprising amount of work done by human fingers.

The hat industry makes requisition upon the world for raw material: Shellac for stiffening from India; skins for sweat-bands, from France; silk, from America, Italy and Japan; dyes, from America and Germany.

Danbury has been the producer of many types of hats: The original high "beaver" hat; silk hats; soft felt or derby hats; women's felt hats, and finally straw hats. The silk hat was invented in 1830 by a Chinaman. A Frenchman, one M. Botta, residing in China, found his tall fur hat too worn to wear. He was unable to

The Frank H. Lee Company
Danbury, Conn.
Manufacturers of Soft, Stiff and Straw Hats

find another in the country and was in despair, as no gentlemen of the time wore any other kind of headgear. Appreciating the proverbial skill of the Chinaman, he took his hat to a Chinese hatter and asked him if he could make one like it. The Oriental thought he could. M. Botta left his hat with him and in a short time the workman brought him a hat like the one he had left. After a time M. Botta returned to France and gave the hat to a hatter to press. The hatter was struck with the quality of the hat, and on examining it more carefully, discovered it to be made of silk, not of fur. Out of this incident grew the silk hat industry, which in 1835 was introduced into Danbury, but was not long continued there.

The hatting industry is a difficult one, and the intricate technical requirements demand vigilant attention to the details of manufacture both in scientific skill and factory discipline. This is exemplified by the fact that, according to the records made available to the author, of the fifty hat factories in Danbury today, only six belong to the group of thirty-three that existed there in 1895. These are:

(1) The Mallory Hat Company, incorporated 1823.
(2) Meeker Brothers Company, 1861.
(3) D. E. Loewe & Company, 1879.
(4) Von Gal Hat Company, 1887.
(5) H. McLachlan & Company, 1892.
(6) The Frank H. Lee Company, 1885.

The Meeker Brothers Company, established in 1861 by John G. Meeker, now has a capacity for one hundred fifty dozen soft fur felt hats per day. McLachlan & Company were organized in 1892. The business of making hats in the rough to be sold to other concerns

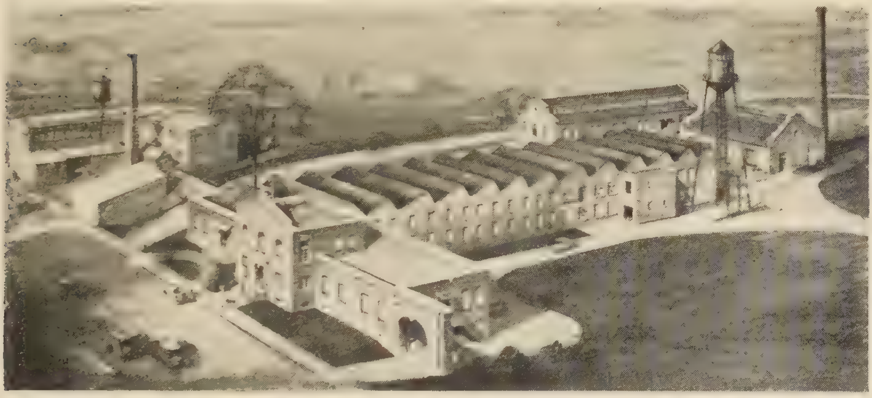
which make a specialty of finishing hats is a comparatively recent development. Originally, about thirty years ago, a few such hats in the rough—shapeless hat forms—were made to be sold here and there to renovators operating in their own stores. Gradually, however, secondary concerns grew up which finished hats according to their own styles, and now rough-hatting is a well established branch of the industry, about three thousand dozen being produced per day, with the output increasing in number yearly. The McLachlan Company was a pioneer in this field, and is now one of the leading producers. The Hawes, Von Gal Company, now the Von Gal Hat Company, was organized by Edward J. Von Gal, a native of Danbury. After finishing his apprenticeship, he established a business of his own, making a specialty of selling his product directly to retailers instead of following the usual custom of selling in quantity to the great distribution houses. In 1898 he combined with the Hawes Hat Company of New York, their hats being retailed as "Hawes Hats."

Another prosperous and prominent Danbury concern is The Frank H. Lee Company, founded by Mr. Lee in 1885. It has had an interesting career and now produces mens' soft finished fur hats, straw hats, and unfinished felt hats. The company is capitalized for $715,-500, and employs 800 hands.

In 1865, John W. Green began the manufacture of stiff hats in Newark, New Jersey, under the firm name of John W. Green & Company. In 1885, the company moved to Danbury. In 1905, the firm was incorporated under the name of John W. Green & Sons. At this

Arthur E. Tweedy,
President, 1924

James D. Biggs,
Secretary, 1924



Tweedy Silk Mills, Inc.,
Danbury, Conn., 1911. Plant completed 1923

Original Factory, 1891

time, they added the manufacture of soft hats. The output of this concern has increased from 200 dozen hats per day in 1905 to 300 dozen per day in 1925. About 400 workmen are employed. During the war the Green factory renovated about 500,000 army hats, together with the simultaneous manufacture of stiff and soft hats.

The making of hats spread from Danbury to the surrounding towns, there being eleven factories in Norwalk by 1825. As early as 1840 about thirty-six thousand hats per year were made there. In Fairfield County there are now, according to the 1923 Factory Inspector's report, seventy-three factories engaged in making hats, parts of hats, or hat machinery. Of these, fifty are in Danbury, nine in Norwalk and East Norwalk, nine in South Norwalk, six in Bethel, the remainder being in Glenville, Sandy Hook and Westport.

The Norwalk Hat Manufacturing Company, Incorporated, manufacturers of fur hats in the rough, was organized in 1922, and now does an annual business of $200,000, employing sixty people. The Tweedy Silk Mills, Incorporated, makers of hat bands and braids, was organized in 1887. It employs today one hundred people. At one time New Haven County made a number of hats, but the business has declined, owing doubtless to the intense localization around Danbury. The remaining factories made caps, rather than hats. Prominent among these are the Hat Manufacturing Company, Incorporated, and the Davis Pope Company, both of Norwalk; and The Bates Company, of New Milford.

As is always the case where an industry is so intensely localized, other allied industries have grown up

around the hat factories, prominent among which are Doran Brothers, manufacturers of machinery.

Doran Bros. of Danbury are designers, patentees and builders of high-grade, automatic, hat-making machinery. The business was founded in the Sixties by the late Charles H. Reid; Doran Bros. being his successors in 1903. Mr. Reid was a pioneer inventor of labor-saving, automatic hat machinery, as well as having been engaged in the development of machines in other fields. The Reid drill chuck, which has been in use for years, and is still in general use, was his invention. In 1919, because of increasing business, Doran Bros. found it necessary to erect and equip a large and modern plant. Most of the product built by this company is designed by members of its own organization and is protected by patents. The use of their automatic machinery is general throughout the hatting world. In the world's hat trade, this firm enjoys the reputation of building the most completely automatic and the best mechanically perfected devices in use in the hat industry. The Doran machinery, particularly that which is used in the finishing departments of hat making, has revolutionized finishing methods. It has been the means of changing the methods of work in this department over that which was generally hand operated to a more uniform and more efficient accomplishment with more perfect product.

The list of Danbury and Norwalk manufacturers show such allied products as hatter's glue, hatter's machinery, fur cutters and fur dyers, silk hat ribbon and braid, hat wires, hat blocks, hat boxes, sweat bands, etc.

As has been noted, the hat industry has frequently

Doran Brothers, Danbury, Conn., U. S. A.
Patentees and Builders of High Grade Automatic Hat Making Machinery. Plant and Office at Danbury, Connecticut.

been involved in labor troubles, and has been a stronghold of Unionism. No attempt to tell the story of Danbury hatting would be complete without an account of the famous "Danbury Hat Case," the outcome of the long and determined struggle of D. E. Loewe & Company, to maintain an open shop.

D. E. Loewe & Company began the manufacture of soft fur felt hats in May, 1879, in the so-called Sturdevant factory located in the Beaver Brook district, Danbury. Its capital was limited and in consequence it had to do business in a small way, relying principally upon its own efforts. In the early spring of 1880 the firm moved to the so-called Union Shop, in the rear of River Street, where it is still located. Later on, enlargements were made and new property acquired, and the successful manufacture of felt hats was established. Up to 1885 it continued to be prosperous in this line, but at about that time the increased popularity of the stiff hat so lessened the demand for the product that the company decided to manufacture the competing type.

The following account of the historic labor controversy is given in the words of D. E. Loewe, the head of the employing litigants.

"In the winter of that year, 1885, the manufacturers of Danbury, apprehensive of the Knights of Labor control, organized and entered into an agreement with the different organizations of the hatters unions by which a system of arbitration was adopted that did away with strikes and interruptions of operation. This agreement worked quite successfully for a number of years. However, the closed shop condition under this arrangement affected the cost of manufacture and in time made it

difficult for Danbury to compete with other districts where open-shop conditions prevailed. This was due to the higher cost of labor and to the restrictions imposed by the union, especially in regard to the number of apprentices allowed and the jurisdiction assumed by the union over labor not necessarily skilled. The request of the manufacturers for more freedom in the employment of labor was followed by many conferences, extending over a period of several months, but the different unions were obdurate and finally declared during the month of October that no concessions would be given. When the manufacturers found that it was impossible to obtain any relief in the prescribed way, they decided after due consideration that they would withdraw from the agreement and gave notice to that effect on the 20th day of November, 1893. The notice was as follows:

NOTICE

Owing to the extreme dullness of trade and our inability to compete with goods made in independent shops, together with the failure of our efforts to obtain sufficient liberties from the Trade Unions, negotiations for which have been pending for several months, we have decided to discharge all our employees on the twenty-fifth day of November, 1893.

When the conditions of trade will warrant it and we can make satisfactory arrangements with a sufficient number of operatives in each department, we expect to resume work as an independent shop.

For a full understanding of our necessities, we desire that you will carefully read the Explanatory Circular which has been prepared for you. We assure you that nothing but absolute necessity has made us take this course, and that we have no other than kindly feelings towards those who have been in our employ.

"It was felt in the early part of January that business was beginning to be active again and the manufacturers decided to open their factories on January twenty-fifth,

Factory of D. E. Loewe & Co., Danbury, Conn.

sent out notices to that effect, and put up signs stating the conditions under which employment would be given. During the week enough hands returned to a few of the factories so that the union decided on Sunday to give up the fight and allowed the people to return to work under the conditions imposed by the manufacturers.

"Six of the eighteen manufacturers who were members of the Manufacturers' Association and who had acted with the other manufacturers all through this trouble, refused to open as open shops and after all the other twelve manufacturers had resumed operations they made arrangements with the union and continued to run union factories.

"The union label which had been adopted and used by the union had been effectively advertised all over the United States, and in consequence the union used the label as a means to induce the manufacturers to again run closed union shops and succeeded in getting nine out of the twelve manufacturers by 1889. It was then that efforts were made to unionize D. E. Loewe & Company, which had strictly adhered to the promise made in 1894—that it would allow union and non-union men to work side by side, and in consequence over 60 per cent of its employees were members of the union.

"The United Hatters of North America having been very successful in unionizing hat factories in all the different hatting districts, and, as stated above, all but three of the Danbury manufacturers having succumbed to the pressure brought to bear upon them to again use the union label, they began to negotiate in 1900 for the unionizing of the D. E. Loewe & Company factory. Several conferences were held with the union officers and after

the last conference in March, 1901, in which he was told that they had made up their minds to unionize his factory and would use their usual methods to bring it about, Loewe was requested to give a definite answer to their proposal. About two weeks after he was called upon by two of the officers for his answer. He told them that he would reply by letter and in April he issued to them his 'declaration of independence' in the form of a letter, stating his convictions that the open shop policy where union and non-union men had worked in harmony for years was best and 'Firmly believing that we are acting for the best interest of our firm; for the best interests of those whom we employ and for the best interest of Danbury in operating an open factory, we hereby notify you that we decline to have our factory unionized and if attacked shall use all lawful means to protect our business interests.'

"The following June a number of union men were ordered to leave the Loewe factory and were placed in union factories. By the middle of the month following, July, all but two had returned. In September those who had returned and others were ordered out. These also returned as soon as the laws and ethics of the union allowed them to do so. No further attack was made by the union until they had completed their fight against a large Philadelphia concern, which had been attacked and had for fourteen months stubbornly resisted the unionizing of their factory until the middle of July, 1902, when they finally gave in to the union. The following week, on July 24th, Mr. Loewe was called on the 'phone by the union officers, who requested his presence at the Groveland Hotel to meet the National officers, who were meeting there. He refused to meet them, stating that

if they wished to see him he could be seen in his office at the factory. Thereupon orders were issued to the union men to attend a meeting the following morning at eight o'clock. At this meeting they were told that the Executive Board of the United Hatters of North America had decided to unionize the factory and they expected to execute this in short order, and warned every man that they must obey the orders of the officers if they expected to make a living at hatting, for their plans were all made, and they were sure of success as they had never lost a case and that they would not lose this one. 'If he should fill his factory with non-union men up to the roof, it will do him no good as we are ready, our men are ready to go on the road and destroy his business.'

"Under this threat the men stopped work. Missionaries from the union working among the non-union men persuaded them to attend the meeting on the twenty-sixth and by threats and coercion they were won over so that by the following Monday, the twenty-eighth, there were only eight men left in the two principal departments. When the men came for their pay, Loewe spoke to them, telling them that the factory would not be unionized in spite of anything the officers were telling them, that they could rely upon his word and anybody that would remain in his employ would be looked after; but this was of no avail. The men left, reluctantly, but they thought the power of the union was too strong to oppose.

"Believing that the good sense and judgment of the men who had been in his employ for so many years would induce them to come back to work, nothing was done to replace those who had left with non-union men or learners until two or three weeks had elapsed. By

that time a few men were secured to learn the trade, although the factory was picketted, and the real fight had begun.

"Customers in different parts of the country began to write calling attention to the fact that emissaries of the union had visited them and their customers, asking them not to buy any more Loewe hats. A systematized boycott of the Loewe product was begun all over the country, and while the factory was gradually filled with men it was soon found that their product was not wanted, owing to the fierce boycott instituted by the United Hatters of North America in conjunction with the American Federation of Labor.

"In September, 1903, D. E. Loewe & Company, with the assistance of the Anti-Boycott Association, organized for that purpose during the early part of the year, brought suit for damages in the Superior Court of Fairfield County, against the members of the Hatters' Union, attaching real estate and bank accounts of over two hundred members in Danbury, Bethel, and South Norwalk. The officers of the American Federation of Labor, as well as the United Hatters of North America were named as defendants.

"Soon after the officers assured the men that they need not fear—'He cannot do anything. Wait until we get his California customer and then he will give in.' Then they attacked a large customer in California, who had been very loyal, and with the aid of the well-organized and most powerful trade unions in San Francisco and other cities in California they instituted a very fierce boycott against this concern for selling the Loewe product. In the midst of this fight, in May, 1905, Loewe went out to San Francisco and applied to the

United States Circuit Court of that district for a restraining order. This was granted and after a year an injunction was not only obtained but was made permanent and thereafter the boycott ceased in California.

"In 1908, after slow progress through the lower courts, the suits were heard in the United States Supreme Court and the famous decision was rendered which declared the United Hatters of North America, and the American Federation of Labor were liable under the Sherman Anti-Trust Act. The case was brought back to the Trial Court and the trial began in October, 1909, in Hartford, and was given to the jury on February 3rd, 1910, when damages to the amount of $74,000. were awarded, which automatically tripled, bringing the amount to $222,000. An error was found in the charge to the jury by the Circuit Court of Appeals and a new trial ordered, which began in the latter part of August, 1912. On the eleventh day of October the jury awarded damages to the amount of $80,000. the full amount asked for in the suit. The automatic tripling of this amount brought it to $240,000, to which the cost of the suit was added, making the total amount $252,000.

"In due time the collection of damages was begun by collecting the amounts attached in the Savings Banks. A controversy arose as to the accumulated interest and which finally reached the Supreme Court, who decided that it should be paid with the principle.

"In order to save the homes of the defendants the United Hatters of North America appealed to the American Federation of Labor, who had assisted them in the defense and assessed the members of the American Federation of Labor to raise a sufficient amount to

satisfy the award. Reluctant to use this money, they allowed the preparation of the selling of the property at auction, but at the last minute they finally agreed to meet the attorneys and an arrangement was made which resulted in a final settlement on July seventeenth, 1917. Within a month thereafter the strike was called off by the union announcing that the Loewe factory was now an open shop and union men allowed to work therein. This definitely settled the so-called 'secondary boy-cott' so effectively used for so many years by labor unions to enforce their will upon the employers and business men."

The Davis-Pope Company, Incorporated, makers of soft felt hats, is also a new concern, one or two incidents of its career in connection with the labor problem being notable. D. L. Davis in 1920, with a capital of $1,400, started to make hats in a little shack in East Norwalk, Connecticut. After a period during which he made and sold his product single-handed, he secured assistance and further capital and within a year the little factory was thriving with other similar concerns all over the country in the post-war boom. The collapse of this period of prosperity sent to the wall many an older concern, the hat industry being particularly crippled by the drop in the price of fur felt to one-quarter its purchase price. Like the other manufacturers, the new company had considerable stock of felt on hand. Realizing that loss was inevitable, Davis decided to make it as small as possible. He canvassed his leading patrons, contracting to sell them hats at a figure lower than cost of manufacture, but one which would consume his high priced stock at a minimum of loss. Returning to his factory, he then called

his employees together, pointed out the inactive factories all about them, explained that he would continue to operate at a loss and why. The employees thereupon agreed to a reduction of wages which allowed the factory to break even and at the end of a year, disastrous to the hat manufacturers, found the Davis factory in a more secure position than before. The firm was joined by A. E. Pope and the name became Davis-Pope Company, Incorporated, eighty per cent of their operatives being stockholders in the firm. Within the four years of its existence the company has reached a point of half a million dollars annual business.

Before leaving the hat industry in Connecticut, some mention should be made of straw hats. The manufacture of this popular article of apparel for both men and women was well established in the United States by 1850. Women were the pioneer inventors in this field, as it was their common practice to make their own straw bonnets. According to a corpulent old volume on American manufacturers, which abounds in interesting, if not always reliable anecdotes, entitled "The Great Industries of the United States," compiled in Hartford, Miss Betsy Metcalf in 1872 invented a type of straw-work which laid the foundation for a considerable business in straw hats in Dedham and Wrentham, Massachusetts, and Providence, Rhode Island.

"Though only twelve years old at this date and without any previous knowledge of the art, she made—from oat straw, which she smoothed with her scissors and split with her thumb nail, a bonnet of seven braids, with bobbin insertion like open-work, and lined with pink, in imitation of the then very fashionable style of English bonnets. The straw was bleached by holding it

in the vapor of burning sulphur." This bonnet attracted the admiration of ladies in the vicinity, manufacturers took it up, and the young girl instructed operatives in her method.

In Connecticut, Miss Sophia Woodhouse of Wethersfield sent in 1821 to the Society of Arts in London, samples of a straw material made from a local grass to be used in hat-making in imitation of Leghorn. London dealers pronounced the bonnet superior in fineness and color to their best Leghorn, and Miss Woodhouse was awarded a silver medal and twenty guineas on condition of her furnishing the society with the seed and process. The same year she and one Wells were granted a patent for making bonnets and hats of grass.

The History of New Haven County mentions manufacture of straw hats as centering in Milford, where "straw hats for headgear are made by machinery and straw sewing machines. At one time there were seven hundred persons engaged and thousands of dozens of hats were finished in one day." This lead to the establishment of the manufacture of floor matting in 1888 which continued there for some years. The industry has declined, for the Connecticut reports show but one straw factory in Milford, Crofutt and Knapp, makers of straw hats. Some of the Danbury hat companies have also added straw hats to their products.

With the exception of its susceptibility to labor disputes, the hat industry has developed from similar beginnings and along the same general lines as other characteristic Connecticut industries. There have been the same household methods, the same localization and the same growth into larger units. It has also had, in the case of the Mallory concern, that persistence of family management which has been exhibited in various other prominent Connecticut industries.

DIVERSIFIED INDUSTRIES

IN the previous chapters of this volume industries have been grouped so far as practicable according to their kindred character and natural relationships. There are, however, various important manufactures in the State which do not seem to fall within any of the foregoing groups. These are here treated under the general head of "Diversified Industries."

In this connection, an important principle should not be lost sight of. We have seen how Connecticut has been a leader in the production of a long list of commodities, prominent among which are brass, silk, hats, clocks, builders' hardware, silverware, rubber, machine tools, munitions and vehicles. On the whole, there is probably a greater variety of articles manufactured in Connecticut than in any other state. The extent of this list has been a saving factor in Connecticut's history. The Connecticut Yankee never has put all of his eggs in one basket, and for this reason the State has generally come through the various periods of national stress and industrial depression better than most of its sisters of the Union. Diversified industry is an insurance against panics, as diversified farming is an insurance against draught and blight.

Paper and Printing

Paper making and printing were among the early Colonial enterprises particularly frowned upon by the British Crown. Previous to 1776 there were only seven paper mills in New England, one of which was located in Connecticut. This was the mill of Colonel Christopher Leffingwell of Norwich. The mill was erected

in 1768 on the promise of State assistance amounting to two pence a quire on writing paper, and one penny a quire on printing paper. The State agreed to furnish the bounty for two years and this contract was carried out.

The agitation caused by the Stamp Act, by which paper was heavily taxed, encouraged the establishment of many new mills in the Colonies. The coming of the Revolution found a paper mill in East Hartford established to supply paper for "The Connecticut Courant." This historic journal had been issued first on October twenty-ninth, 1764, and has appeared regularly from that time to the present day with the exception of four issues (weekly) from December 1775 to January 1776, when there was no paper available.

One of the most serious difficulties in the early manufacture of paper was inability to secure a sufficient quantity of rags and waste. The early files of "The Courant" abound in appeals to subscribers for this material. That this condition was general throughout the Colonies is evidenced by the following advertisement which appeared in "The Boston News Letter" just prior to the Revolution—"The Bell-cart will go through Boston before the end of next month to collect rags for the paper mill at Milton, when all people that will encourage the paper manufactory may dispose of them."

The East Hartford Company was organized by Thomas Greene, editor of "The Connecticut Courant," and Messrs. Watson and Ledyard, the last two names only appearing in the firm name. This company supplied paper for the eight thousand weekly issues of "The Courant" and also the greater part of the writing paper used by the Continental Army.

The next mill to claim attention was established in Danbury in 1787 and had an annual product of fifteen hundred reams, which was considered a very large output. The paper manufactured in both of the mills at this time was of dark mottled appearance and crudely made. About the beginning of the nineteenth century the use of chlorine for bleaching, discovered by Schule and others, became known in this country and a much better quality of paper resulted.

The subsequent rise of the paper industry in Connecticut does not present as connected a story as is the case with certain other lines. There was no common center or group of men around which the industry developed. Our nearest approach to this was in Norwich and East Hartford, where the manufacture of paper and cardboard seemed to center during the fifty years following the Revolution.

The Leffingwell mill, early established in Norwich, remained for several generations in the family under the firm name of A. H. Hubbard Company. It was the first mill in America to operate a Fourdrinier machine, the invention of a Frenchman, whereby the old process of making paper entirely by hand, one sheet at a time, was improved upon. This new machine was built for the company at Stafford, by Phelps & Spofford. The drying cylinders were not added until 1831.

Among the pioneers of the industry was the Chelsea Manufacturing Company, described in one of the mid-century histories as "The Greenville Mammoth Paper Mills." In 1860 these mills were considered among the largest of their kind in the world. Somewhat later the Uncas Paper Mills at Thamesville were established. Montville, near Norwich, is now a paper manufacturing

center. One of the earliest mills to be established there was the Montville Paper Company, founded in 1851 by Oliver Woodworth. It was bought in 1863 by Carmichael Robertson and has retained the name Robertson Paper Company. This mill, like most of the Norwich paper mills, manufactures cardboard and boxes rather than paper. Robertson later bought two other mills, the Rockland Mill and the Bank Mill, and all three remained in the family until 1916 when they were sold to Boston interests and incorporated together under the present name.

Of the ten or fifteen mills remaining in New London County there are only two now producing paper, the Montville Paper Company and the Du Pont De Nemours plant at Norwich. The balance manufacture paper tubing, cardboard boxes and containers, and strawboard. Most of these, too, are recently established companies; the early companies having for the most part gone out of existence or entered other manufacturing fields.

The early paper industry in Danbury and vicinity was short lived, for in less than fifty years Fairchild's mill at Bridgeport became the only paper mill in the county. A large plant also grew up at Seymour, the outgrowth of a paper mill started by General Humphrey, of woolen fame. This plant was later called the S. Y. Beach Company and made a specialty of colored papers.

After the Watson & Ledyard Company, the present East Hartford Manufacturing Company at Burnside, is among the oldest. Founded in the latter part of the Revolution as the Goodwin Company, it was later known as the Hudson & Goodwin Company, the Keney & Boswell Company, Hanmer & Forbes Company, and in

1865, by the present name. This firm manufactures only high-grade paper, such as wedding stationary, ledgers, bonds, and linens.

The Pacific Mills in Windsor Locks are large producers. Indeed Hartford County would now appear to be the paper center of the State. Webb, writing in 1882, mentions, in the district along the Connecticut River, the Hartford Paper Company, Hodge & Son, manufacturers of tissue paper, and House and Company, specializing in press boards. There are now in this area about twenty-five mills. Prominent among these are the branches of the American Writing Paper Company in Manchester, Unionville and Windsor Locks.

Charles Bunce, who learned paper making in the Hudson and Goodwin Company, started a mill in Manchester and, followed by his six sons, the firm carried on a celebrated paper manufacture for sixty years. Various mills were established in the vicinity, and it is largely due to the ability of this family that paper industry has retained its importance along the Connecticut River. At one of the Bunce mills, three Case brothers—C. Frank, A. Wells, and A. Willard—learned the paper making trade and in 1862, with a joint capital of $135 started a paper mill in Highland Park, a part of Manchester. The Case brothers were able manufacturers and built up a flourishing business. They also built paper machinery in Manchester and made valuable inventions in this connection. Case Brothers, Incorporated, at present make about twelve tons per day and the family own and operate other mills in Manchester, South Manchester, Unionville and Burnside.

Another old firm is C. H. Dexter and Sons, Incor-

porated, of Windsor Locks. In 1767 Seth Dexter of that town, having in view the timbered hills and growing community, erected a saw mill which his son and grandson carried on. Later C. H. Dexter began to experiment in the manufacture of paper in the basement of the old mill, using manila rope for pulp (1835). He was the first to make paper out of this material and his success, as in the case of so many other inventors, was partly the result of an accident. A workman in charge of the machines for masserating the fiber fell asleep and the material remained there for a considerable length of time, and thus it was found that time was what was needed for the process. The new paper was, of course, of a very tough and durable quality. Dexter papers are largely used for cover papers for catalogs and other purposes where non-tearing qualities are essential, although other and thinner papers are also manufactured by the concern.

The St. George Paper Company of Norwalk is noteworthy as the only mill in Connecticut to manufacture newsprint paper. Established in 1902 in the face of much pessimistic prophecy, and far from the source of the spruce wood supply for raw material, it is one of the two newsprint paper mills in the East. It was established in the belief that it could afford to manufacture at higher costs in order to supply an untouched local market, and events have confirmed the wisdom of the venture. In 1920 the "New York World" purchased the business and has continued to operate it, the newspaper itself consuming sixty per cent of the annual production. The remainder of the output is sold to newspapers within the State. A large paper box factory, isolated from other paper centers, is that of E. J.

Paper Mill of C. H. Dexter and Sons, Inc., Windsor Locks, Conn.

Doolittle in Meriden. It was established in 1860 and has since produced nearly every variety of paper box from the cheapest cartons to silk, satin and plush lined jewelry boxes.

Closely allied with the paper industry is the manufacture of envelopes. This did not begin in America until 1830, all work at that time being done by hand. The first United States patent on an envelope-folding machine was issued in 1849 and the manufacture of envelopes by machinery was begun in Hartford in 1865 by Prescott, Plimpton and Company. Although this greatly improved upon the hand method, the machines were still crude and the output per person was limited. In 1866 Louis B. Plimpton became sole owner of the company and later incorporated as the Plimpton Manufacturing Company.

In 1869 Horace J. Wickham, a young mechanic, entered the employ of the Plimpton Manufacturing Company. Although scarcely more than twenty years of age, he was a mechanical genius of the first rank and was soon given a position of responsibility. In 1874 the Plimpton Manufacturing Company, as the lowest bidder, was awarded the United States Government contract for making stamped envelopes. These had previously been made in New York and the methods and machinery for their manufacture were the same as those used by all envelope makers at that time. The Plimpton plant differed but little, if any, from the others and it was only by superior skill, rigid economy, and abatement of profit, that the company hoped to hold its own against competition. Recognizing Wickham's superior fitness, the company placed him in charge of its Mechanical and Manufacturing

Department. With this opportunity at hand his versatile mind lost no opportunity to devise improved methods. As a result, the now famous Wickham envelope machines were invented, which cut, stamped, printed, gummed, folded, counted and boxed envelopes all in the same machine. Thus, one girl attending a machine could do the work previously done by twenty. The cost of manufacturing was reduced from fifty cents per thousand to three and one-half cents per thousand. It is these same machines today which make possible the printing annually of over seven hundred millions of stamped envelopes for the United States Government. A later machine for the printing, cutting, and stamping of wrappers has also added an immense volume of business to the firm. Although the company still maintains its corporate identity, it was purchased by the United States Envelope Company in 1898 and has since then been conducted as a division of that corporation. A company specializing in the manufacture of envelope machinery is that of Lester and Wasley of Norwich.

Also closely allied with the paper industry was an original departure in the book business in Connecticut, due again to Yankee ingenuity in distribution. About the middle of the last century, Hartford made itself famous by inaugurating the now familiar method of selling books by canvassers and subscription. For a long period it lead the United States in this method of conducting the business, sales of one hundred fifty thousand to two hundred thousand volumes of a single work being not uncommon. The canvassers penetrated the outlying districts, tapping a market for books which, under the existing limited methods of communication, was filled

with willing purchasers of newly published works. J. B. Burr and Hyde was one of the leading publishers of books to be sold in this manner. Case, Lockwood & Brainard Company was another. Established in 1836 by Newton Case and E. D. Tiffany, it was soon swamped by the disastrous money panic of that period, but was later revived. The stereotype plates of "The Cottage Bible," a commentary in two royal octavo volumes, were purchased and run, over two hundred thousand copies being sold. For fifteen years this company was sole printer and binder of "Webster's Unabridged Dictionary." In 1852, on the entry into the firm of James Lockwood, the present name was adopted. The printing of textbooks was later undertaken. The company now occupies a position of leadership in the field of commercial and state printing.

The indebtedness of the art of printing in Connecticut to Abel Buel, Killingworth's picturesque son, elsewhere mentioned, should not be here overlooked. He invented a process of casting type, 1769, and with Government aid constructed a foundry for the purpose in New Haven where he employed "fifteen or twenty boys to aid him." This is believed to have been the first type cast in the Colonies and was of especial importance on account of the difficulty experienced during the early stages of the Revolutionary War in procuring type for printing, except occasionally at great risk from France. Apollyos Kinsley, another peculiar and gifted inventor mentioned elsewhere, patented at about this same time a modification of Nicholson's cylinder-press for printing.

Considerable printing machinery is now manufactured in Connecticut, notably by C. B. Cottrell and Sons

of Pawcatuck, the Babcock Printing Press Company of New London and the Standard Machinery Company of Mystic. This localization of the manufacture of printing machinery in New London County may be traced to a once famous company at Greenville, William H. Page and Company. This firm manufactured wooden type, reviving its production for certain purposes, especially posters, after metal type had occupied the field for many years. Finding that metal type was impracticable for the large display purposes that came into vogue by the middle of the last century, one or two printers had undertaken to manufacture wooden type for the purpose. One of these, Edwin Allen of South Windham, although he had constructed workable machines, met with only mediocre success. Another type setter, William H. Page, having also turned his attention to the matter, came by chance to South Windham to live. He invented improved machinery and received financial aid from Samuel Mowry of Greenville, a manufacturer of springs and axles, and finally built up a successful business which he moved to Greenville; and for years his "ornamental wood type and elegant borders" held the market for the "ornamental and elegant" mid-Victorian era.

The mention of Abel Buel in connection with his type foundry suggests the series of historical prints of the Battle of Lexington, issued by him in 1777 and acknowledged to have been the first colored prints made in the Colonies. Buel also made the maps for Morses' Geography and other fine engravings. It was perhaps his example that inspired D. W. Kellogg, who, in his little shop in Hartford, located where the Municipal Building now stands, became the first commercial lithog-

THE BABCOCK PRINTING PRESS MANUFACTURING CO., NEW LONDON, CONN.
Established in 1882 through the untiring industry and inventive genius of George P. Fenner

rapher in the United States (1832)—although the art of printing from stone had been invented in 1774 by Aloys Senefelder, a Bavarian. D. W. Kellogg's sons succeeded him and the business was finally incorporated 1868 by a grandson, Charles E. Kellogg, and General William H. Bulkeley under its present name of The Kellogg and Bulkeley Company. This was the first concern to adopt the so-called "off-set" lithography in New England, which has proven a revolution in the art.

In connection with printing, it should be noted that rubber stamps, the boon of all offices, were first invented by a Hartford printer.

Chemical Products

There is manufactured in Connecticut a large line of soaps, toilet articles, medicines and other commercial products which are the result of chemical formulae. These are here broadly classified as "chemicals." Space will permit of only a cursory review of the more important items under this classification.

Many of our present day soaps and toilet preparations are traceable to the inventive genius of James Baker Williams. In 1834, then a young man, he entered the employment of the F. and A. C. Woodbridge's general store in Manchester as a clerk. One of the partners of this firm was an apothecary and young Williams soon learned to put up prescriptions, meanwhile pursuing the study of chemistry evenings.

While in Manchester Williams became convinced that there was an increasing demand for a better quality of shaving soap. He began experimenting and after two years brought out the "Williams Genuine Yankee Soap" which was introduced on the market through neighbors

and friends. A partnership was formed with his brother, George W. Williams. This new soap found such a ready sale that score of imitations from Philadelphia and New York compelled the Williams Brothers to bring suit in order to maintain their trade-marks. The firm was continued in Manchester until 1847 when it was dissolved, James B. Williams moving to Glastonbury. Here he rented from his father-in-law a small grist mill and began the manufacture of shaving soap and a few other products. A few years later, another brother, William S. Williams, joined him and the name changed to J. B. Williams and Company. In 1885 a joint-stock company was formed known as the J. B. Williams Company, all of the stock being retained in the family. The company has enjoyed a large and steady growth. Its advertisements are familiar upon the pages of all leading periodicals, and its products are known in every State in the Union, as well as in many foreign countries. Two other manufacturers of well-known brands of soaps are the Orford Soap Company of Manchester, makers of "Bon Ami"; and the Packer Tar Soap Company of Mystic, makers of the equally well-known "Tar Soap."

Another unique Connecticut product is that of the E. E. Dickinson Company of Essex, manufacturers of witch hazel and birch oil. "Witch Hazel" is not believed to grow in any other country and is therefore made only in the United States—mostly in Connecticut. It is, as everyone knows, a healing preparation made from a special hazel wood.

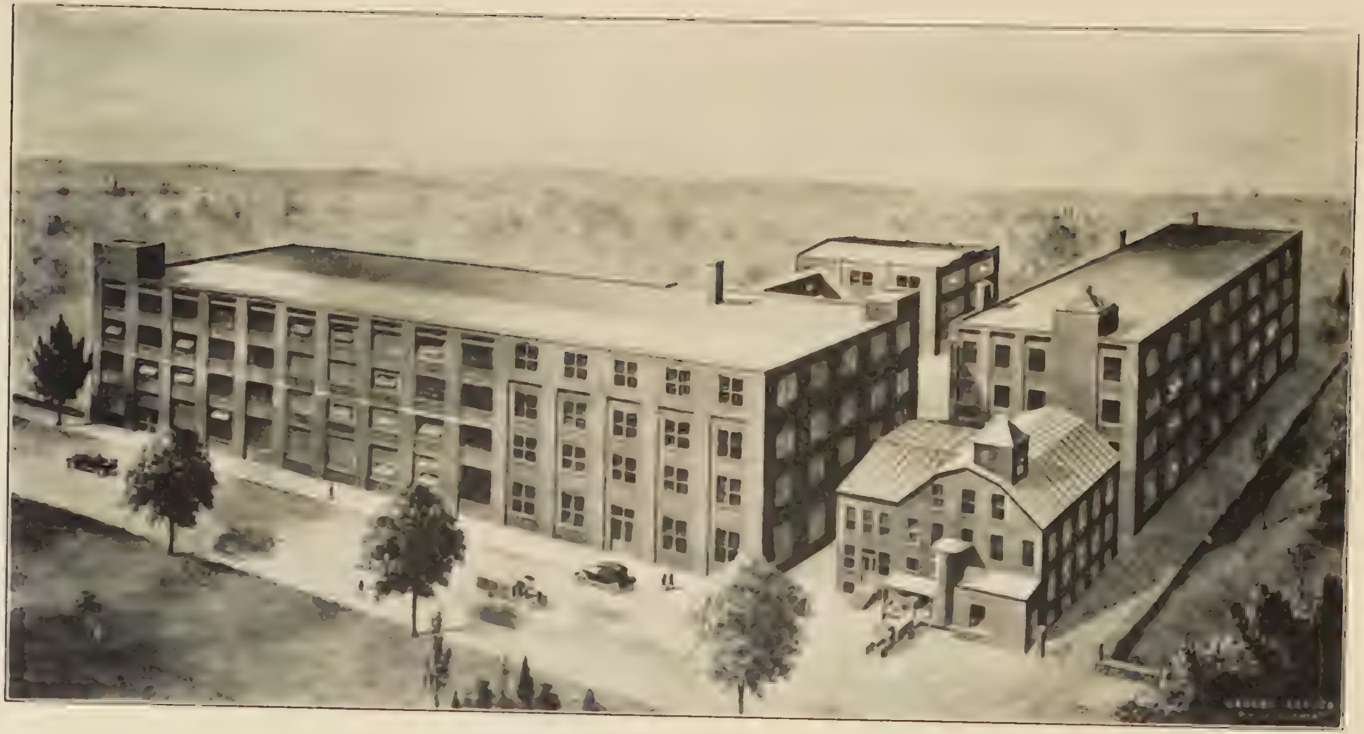
In New Haven is the Kolynos Company, maker of the dentifrice of that name. This dental cream is made according to the formula of Newell S.

Jenkins, an American dentist, whose professional life has been largely spent abroad both in study and practice, his patients numbering various royal and titled persons in Europe. In 1908 he came to New Haven to complete the details of the formula for the dentifrice, spending some time in research at the chemical laboratory of the Sheffield Scientific School of Yale University, in connection with Professors Harry Foote and Leo F. Rettger of that institution. At the conclusion of their labors, the commercial production of Kolynos Dental Cream was begun in New Haven, the dentifrice being first introduced to Connecticut dentists. The business grew rapidly and within the next few years it extended over the United States, Canada, Latin America, Europe, Africa and the Far East, being sold in 77 countries. In 1915 new laboratories were built in New Haven, and there are also factories and laboratories in England. Financed entirely out of its own earnings, the company is now capitalized for over $12,000,000. Kolynos is stated to be the only dental cream of which the prescription is made public.

In connection with these toilet preparations, so many of which reach the consumer in convenient tubes, may be mentioned the Sheffield Dentrifice Company of New London, manufacturing chemists and metallurgists. This company was the first in the country to market a dental cream (Sheffield Creme Dentrifice) in paste form in the collapsible tube, now so familiar. These tubes had been formerly used only in Germany for certain food products, such as fish and soup pastes. The new type of container proving popular, the company undertook its manufacture, and is now the only concern of the sort in the State and the largest in the United States.

The Sheffield Dentrifice Company was founded in 1850 by Doctor M. W. Sheffield, and the New England Collapsible Tube Company was organized in 1904 by his grandsons. The latter company makes a specialty of producing the complete packages for all kinds of toilet preparations sold in tubes, the formula, tube containers, circulars, and paper containers or wrappers all being executed at the New London plant and shipped to customers ready for distribution. Every order has the dealer's name, as if made under his own factory roof. An astonishing number and variety of nationally advertised toilet articles are distributed from this unique Connecticut plant. The annual business totals over $1,000,000 and there are over 400 employees.

Closely allied with this group is the manufacture of "Phillips Milk of Magnesia," the chief product of the Charles H. Phillips Chemical Company of Glenbrook, near Stamford. In 1849, a druggist, Charles H. Phillips began the manufacture of wax candles, and also took up the refining of beeswax for this and other commercial purposes, together with the refining of camphor to be sold in cakes. The enterprise prospered and was moved to its present location. Upon the outbreak of the Civil War, the manufacture of chloroform was added and quantities of the anaesthetic sold to the government, ether not yet having come into general use. After the war, the discovery of petroleum led to the substitution of paraffine candles for wax and Phillips found his business in a precarious situation. He had, however, been carrying on for many years experiments in medical chemistry and finally developed various proprietary remedies which bear his name, the most important of which is the hydroxide of magnesia which he



New England Collapsible Tube Company, New London, Conn.

called "milk" of magnesia from its resemblance to that fluid. The business was carried on by his sons after his death and was sold by them in 1923 to the Sterling Products Company of West Virginia, owners of other proprietary remedies. The Phillips Company does an annual business in excess of $1,000,000.

Although other states, notably Rhode Island, lead in the paint industry, there are several factories in Connecticut. Of these the Parrott Varnish Company is believed to be the oldest. It was founded in 1846 by Frederick Wells Parrott, who had been for twenty years a furniture manufacturer, in which connection he became interested in the production of good varnish. The Parrott varnishes have been made by what is described as "the old English method," which consists of clarifying and aging the product by the natural action of gravity, rather than by filtration and forced aging.

Milk and Ice Cream

"Borden's Condensed Milk," which proved such a Godsend in the Civil War, was the invention of a Torrington man. This Connecticut name now appears on the delivery wagons of cities throughout the land and canned products bearing the "Borden" trade-mark are familiar in every household.

A similar industry, of rapidly growing proportions, is the manufacture and distribution of ice cream. In this, the New Haven Dairy Company of New Haven occupies the position of leadership. The concern was originally planned as a city milk distributing agency, but its attention was soon directed to the commercial manufacture of ice cream. The first application of artificial refrigeration to ice cream freezing in 1905 changed ice cream

from a luxury to an every day food product, which might be easily and safely sold and distributed. Within a year after its development, the New Haven concern utilized the new method, probably being the first manufacturer in New England to do so. The advantages of this refrigeration method has enabled dealers to sell ice cream at practically the same price today as in 1900 when the ingredients and labor cost approximately half as much. The company now has factories throughout the State and to distribute its output utilizes a fleet of over 125 motor trucks. The annual sale of ice cream in Connecticut by this one company is estimated at nearly 5,000,000 quarts. It has 400 employees, and its daily refrigeration amounts to 620 tons. The production of this article of food, whose qualities are highly commended by dieticians is assuming a surprising importance. In addition to the large New Haven concern, there have grown up such considerable ice cream firms as the Semon Ice Cream Corporation of New Haven, the Huber Ice Cream Company of Bridgeport, and the Ce-Brook Ice Cream Company and Hartford Ice Cream Company of Hartford.

Dental Gold

Another unique and better known Connecticut industry is that of gold beating. In this the J. M. Ney Company of Hartford has carried the operations of the art to the highest degree of perfection and has developed the production of metals for dental use to a point of recognized leadership. The use of gold for dental purposes is an ancient art, a group of six teeth fastened together by a gold wire being found in Phoenicia and assigned to the date of about 1500 B. C. But

dentistry remained during the centuries a distinct luxury, and as late as the Colonial days in America it was rarely practiced; and even then as an avocation of the barber, ivory-turner, or wigmaker. The most famous of these early dentists was John Greenwood, who operated upon many famous men of his day. Among them was George Washington, for whom he made several sets of artificial teeth of hippopotamus ivory! Greenwood died in 1819, but before that time Marcus Bull was preparing gold in Hartford especially for dental use. He was a pioneer in the gold-beating profession, and regularly supplied gold leaf to dentists, far and near. Certain dentists, finding the leaf too thin for their purposes, ordered rolled gold made of the purest gold coin, which they brought to Bull to prepare. One day a young apprentice suggested the use of unalloyed gold, which was thereafter employed.

Bull's business passed through various hands, and finally, in 1866, came into the sole control of John M. Ney. In its life of over a century, this gold product has found itself from time to time in strange and dramatic situations. After one of the battles of the Civil War a book of Ney's gold foil was found on the body of a Southern soldier, a dentist in civil life. It had been purchased in Havana, run the blockade, and sold at a great premium to the officer who carried it in his pocket. This gold has also figured in robberies as it crossed the plains by stage coach. There is also a story that when a Sioux warrior had been killed holding up a stage coach near Green River, Wyoming, it was found that his buttons and ornaments were covered with Ney's gold, plunder from a previous hold-up. Although specializing in dental gold, The Ney Company has done consid-

erable other work with precious metals. In 1874 the company received a contract from the State to cover the dome of the Capitol with gold leaf. From a piece of 23 karat gold, about the size of an old-fashioned watch, a gold carpet was beaten to cover the 440 square feet of the surface of the dome. Millions of ounces of silver, too—pure sterling and coin—have passed through the Ney factory to be later fashioned into the silverware for which Connecticut is famous. This company in its various activities constitutes the only establishment of its kind in the country. It has a total business volume of between $2,000,000 and $3,000,000 annually, and its dental products are marketed throughout the world.

Typewriters

If the invention of printing is generally conceded to be the most important single step forward in the march of civilization, the invention of the typewriter is of comparable significance to the business world. It is well nigh impossible to visualize the great business undertakings of today as being conducted without that necessary agency of accuracy, speed and economy. Before its advent records were kept and correspondence maintained by painful effort and incalculable waste of time, often by the active heads of industries themselves. Those quaint old ledgers and blankbooks, filled with script, represent untold hours taken from more vital executive effort. The frequent reply of "Records not to be found" given the author in answer to questions concerning the early history of prominent Connecticut concerns brings before the mind a picture of the old founders engrossed in the instant problems of making and selling, and altogether too busy to make records by

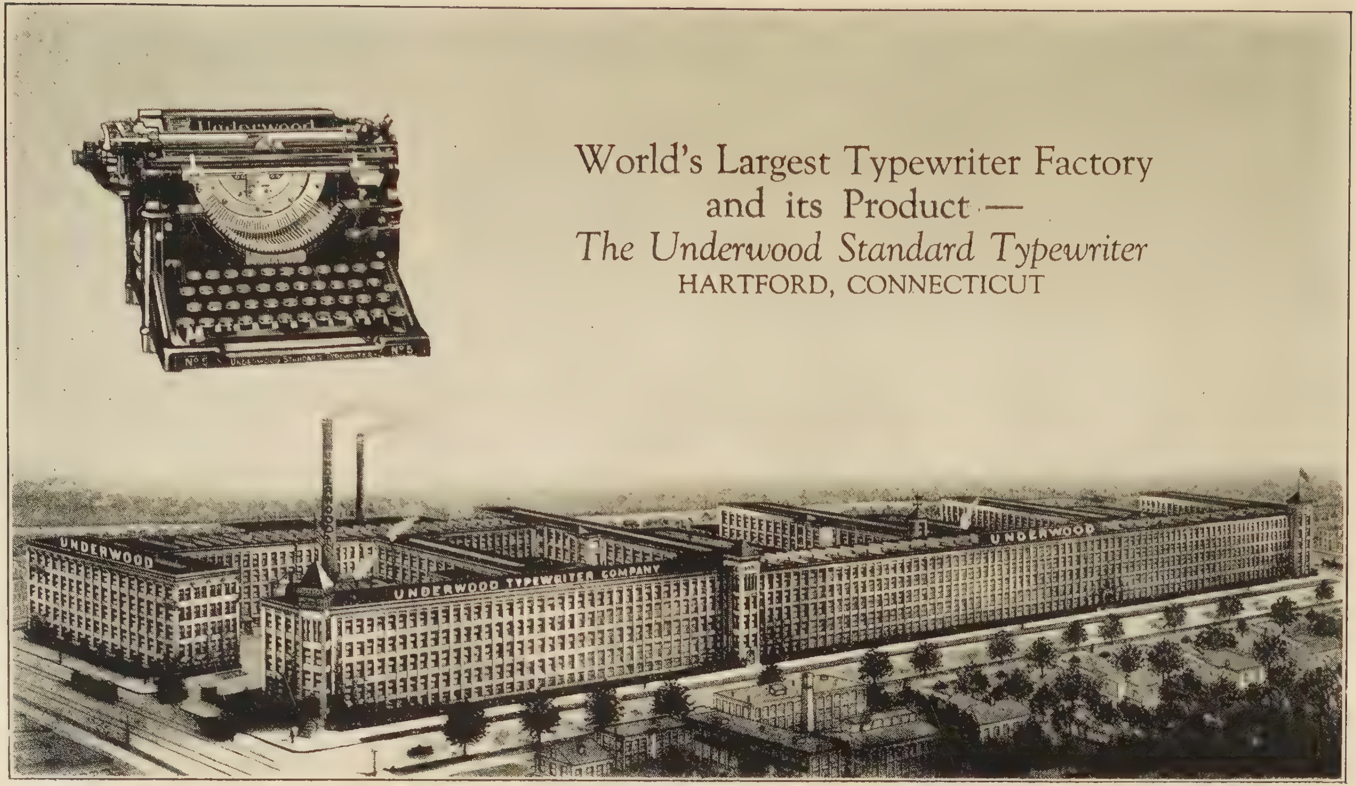
the wretched agencies of quill pen and poor ink. In this era of efficiency and quantity production, the typewriter came, like so many other vital inventions, in response to a demand.

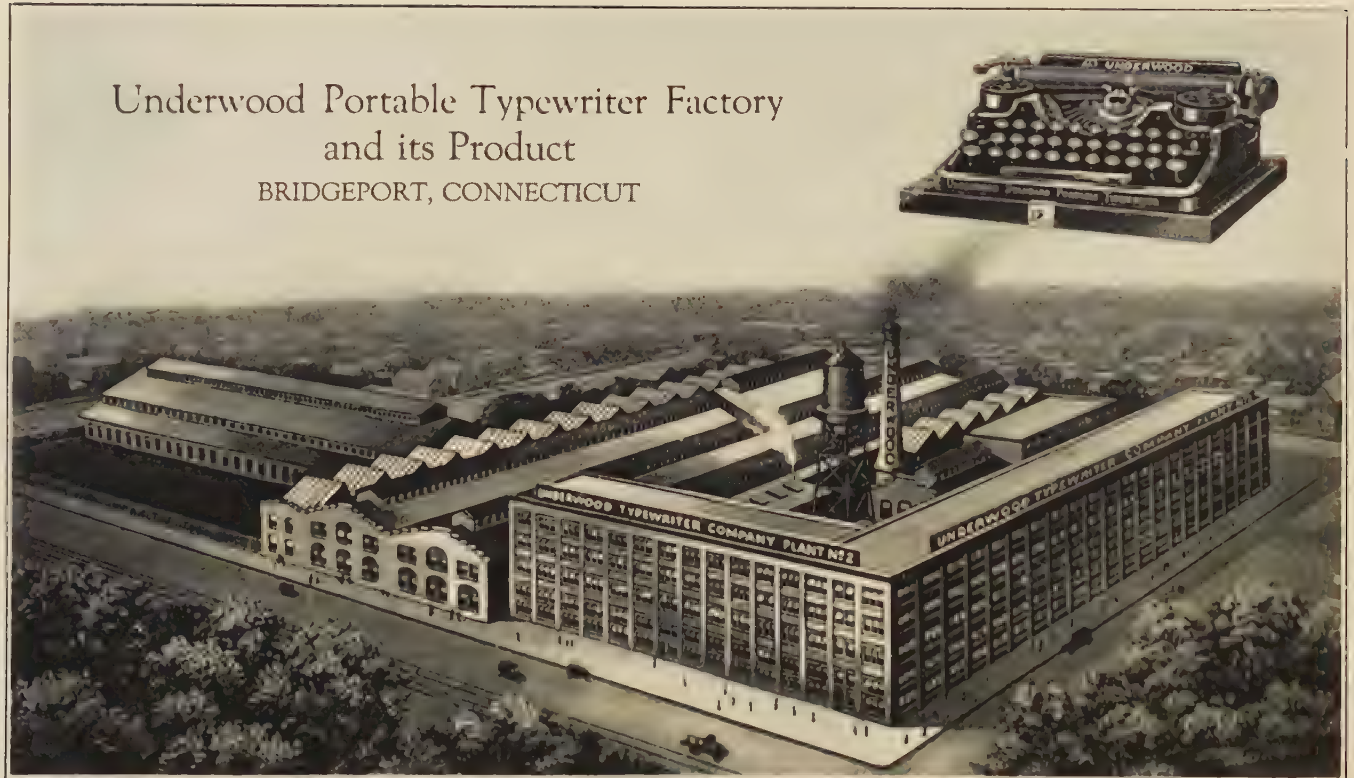
The conception of a "writing machine" is an old one, the first recorded attempt at its invention being found in the British patent lists of January, 1714, where there is reference to "an artificial machine or method for the impressing or transcribing of letters singly or progressively one after another, as in writing, whereby all writings whatsoever may be ingrossed in paper or parchment as neat and exact as not to be distinguished from print." There is no model of this machine—if, indeed, one ever existed—and the model of the first American machine, that of William Austin Burt of Detroit, afterward better known as the inventor of the solar compass, was destroyed by fire at the Washington Patent Office. Later, however, from the evidence of various sources, a replica of the Burt machine (1829) was built and exhibited at the World's Columbian Exposition in 1893 and was revealed as carrying the type, not on individual bars, but on the segments of a circle, which establishes it as the ancestor of the present type of "wheel" machines. Throughout the nineteenth century many models in Europe and America were made, some resembling pianos with the black and white keyboard of a conventional pianoforte and some circular, but all except Burt's unbelievably complicated and unwieldly.

The first practical typewriter, and incidentally the first machine to be so called, was the invention of Christopher Latham Sholes of Milwaukee, in 1867. It was evolved after the usual story of discouragement and ex-

periments with various odd-looking machines. The final form, however, though a crude affair, had many of the fundamental features of the modern type-bar machine. When it was perfected, the inventor and those financially interested, decided to have it manufactured by the already famous firm of gun manufacturers, E. Remington of Ilion, New York, whose history has been given in the chapter on "Munitions." Of historical interest is the account given by Henry Harper Benedict, a director of the Remington concern, of his introduction to this revolutionary office accessory. Mr. Benedict says:

Mr. Philo Remington's office and mine communicated. One day I saw on the mantelpiece of his office something that looked like print. I asked him what it was. He said, "Read it." It proved to be a letter from James Densmore (Shole's partner) setting forth at considerable length the facts in connection with a machine to take the place of the pen, that is, to write by the manipulation of keys. He told who were the inventors, and said that after many years of effort they had finally produced a working model, and they wanted to find someone to undertake the manufacture of the machine. He wished to bring the model to Ilion to see whether the Remingtons would care to take it up. I said to Mr. Remington, "Have you done anything about this?" He said, "No, what do you think we had better do?" "Why," I said, "of course we want to see the machine; it is a wonderful invention, if it is anything, and we should not neglect the opportunity offered us to examine it." The result was that the model was brought to Ilion early in 1873 by Mr. James Densmore. We examined and discussed the machine for perhaps an hour and a half or two hours and then adjourned for dinner. As we left the room, Mr. Remington said to me, "What do you think of it?" I replied, "That machine is very crude, but there is an idea that will revolutionize business." Mr. Remington asked, "Do you think we should take it up?" I said, "We must on no account let it get away. It isn't necessary to tell these people that we are crazy over the invention, but I am afraid I am pretty nearly so."


World's Largest Typewriter Factory
and its Product —
The Underwood Standard Typewriter
HARTFORD, CONNECTICUT
UNDERWOOD
UNDERWOOD TYPEWRITER COMPANY
UNDERWOOD



Underwood Portable Typewriter Factory
and its Product
BRIDGEPORT, CONNECTICUT

Among the early converts to the new device was Mark Twain, then a resident of Hartford. He gave to the manufacturers this characteristic "testimonial:"

HARTFORD, *March* 19, 1875.

GENTLEMEN:

Please do not use my name in any way. Please do not divulge the fact that I own a machine. I have entirely stopped using the Typewriter, for the reason that I never could write a letter with it to anybody without receiving a request by return mail that I would not only describe the machine but state what progress I had made in the use of it, etc., etc. I don't like to write letters, and so I don't want people to know that I own this curiosity-breeding little joker.

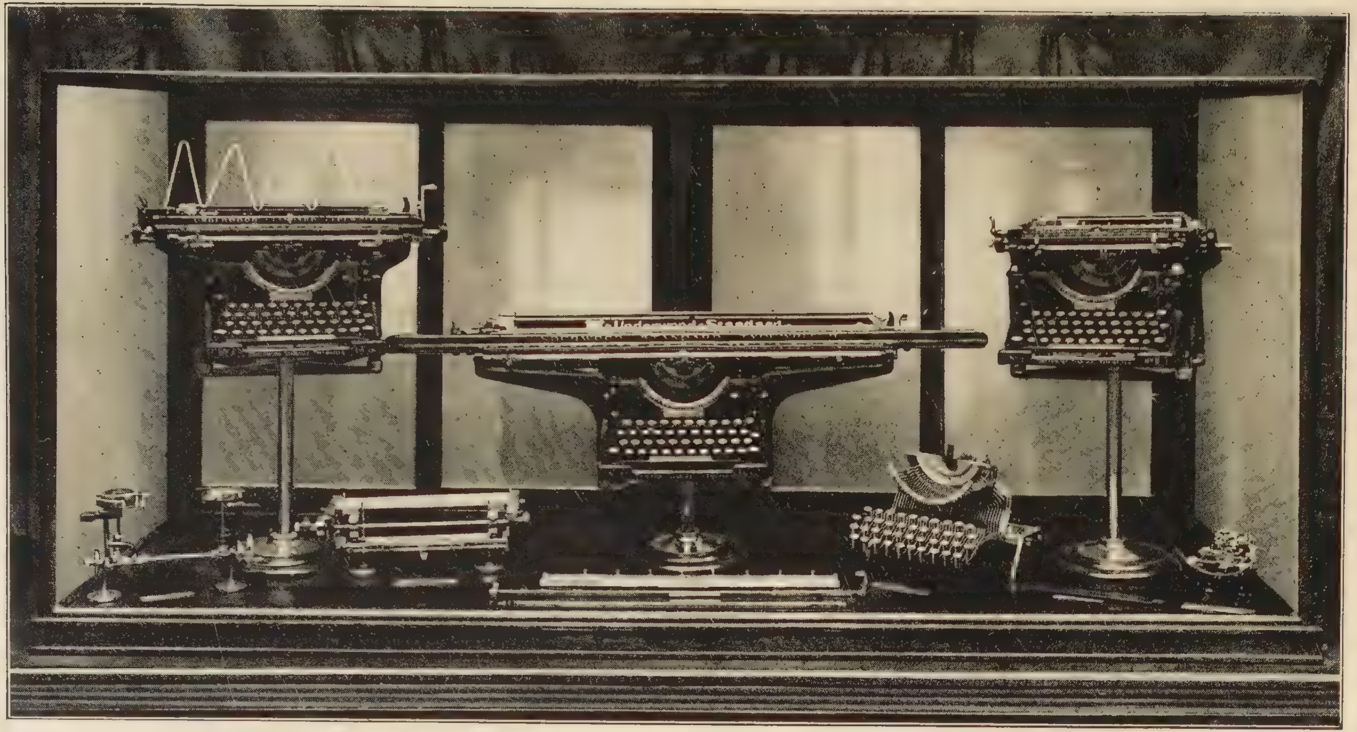
Yours truly,
SAM'L. L. CLEMENS.

The Remingtons later encountered financial difficulties and a selling agency, styled Wyckoff, Seamans & Benedict, moved the enterprise to New York, changing the corporate name to the Remington Typewriter Company. Densmore, the partner of Sholes, the actual inventor, received substantial rewards in the way of royalties, but Sholes himself, with the temperament characteristic of many inventors, lost interest in the device as soon as it became commercially successful, and sold his rights to Densmore for $12,000, which was his sole reward for an innovation that revolutionized office work throughout the world. The "Yost" typewriter, which was at one time manufactured in Bridgeport, but later transferred to London, England, was named for one of Sholes' early associates.

We have sketched the career of the Remington machine because of the historical background it affords, but Hartford is today the typewriter manufacturing center of the world. The largest producer is, of course,

the Underwood Typewriter Company, which came to Hartford from Bayonne, New Jersey, in 1901. The Underwood machine was invented by one Franz X. Wagner in 1894. Its distinguishing characteristic was "visible writing," being the first typewriter to be so arranged that the writer could see his entire page without lifting or shifting either carriage or paper. All modern typewriters have since adopted this improvement, and the typewriter public have become so accustomed to taking the visibility feature for granted that it is difficult now to imagine the inconvenience of the old non-visible machine. The first "Underwood" machine was sold in 1897. John T. Underwood and Dewitt Bergen, president and treasurer of the company respectively since its outset, assumed the executive responsibility. The company was first organized as the Wagner Typewriter Company, but was later organized under its present name. From its inception until it removed to Hartford, the company manufactured only about 15,000 machines. It has since manufactured something over 2,500,000. An additional factory has been established in Bridgeport to accommodate the increasing business and the two factories united are now producing around 275,000 machines annually, and employing about 8,000 men.

The Royal Typewriter Company is next to the Underwood Company in the volume of production. This company was organized in 1906, occupying part of a plant at Bay Ridge, New York. In 1907 it purchased a plot of land of about seven and one-half acres in Hartford and erected a modern factory four stories high. Its domestic and foreign business increased enormously and branches were opened throughout the country and Europe. In 1917 and again in 1920 additions to the



Group of Underwood Typewriter Models

Upper left to right—Underwood Billing Machine, Model 3 Wide-Carriage Machine, Model 5 Standard Correspondence Machine
Lower left to right—Ribbon, Carriage, Typebar and Escapement Mechanisms

plant were built. "Royals" can now be purchased in practically every city in the world, and are being operated in nearly every language—Arabic, Hebrew, French, Russian, Spanish and German. Several thousand persons are employed in the plant, with a selling force of many hundreds in addition.

The newest of the four typewriters which have been manufactured in Connecticut is the "Noiseless" typewriter of Middletown. In this machine, as the name suggests, the tapping noise of the keys has been largely eliminated. This machine is the joint product of W. P. Kidder of Jamaica Plains, Massachusetts, and C. C. Colby of Stanstead, Quebec. At the time of their first meeting in 1891, Kidder had invented printing presses and two typewriters, the Franklin and the Wellington, and at that time was engaged in marketing the latter machine.

Sewing Machines

It would be as difficult to conceive of the home without the sewing machine as the office without the typewriter. The first step toward the designing of this household necessity was taken by an Englishman, one Thomas Saint, who in 1790 patented a chainstitch machine which incorporated many principles still in use today. But his model lay forgotten for sixty years, while others reinvented the principles and carried them to completion. In France, Barthelemi Thimonnier, in 1830, patented a sewing machine of which eight were constructed and used to make army uniforms. This machine was capable of making 200 chain stitches a minute. The tailors and seamstresses who saw it at work were terrified by the fear of losing their employment and, mobbing Thi-

monnier's workshop, smashed the machines. He never recovered financially and his project lapsed in France until after the American success.

Like the typewriter, the sewing machine, although attempted by European inventors, became a distinctly American development. The early attempts had no appreciable influence upon the construction of the first practical machine, which was that of Elias Howe of Spencer, Massachusetts, who in 1846 obtained a patent for a sewing machine which had a curved eye-pointed needle for the upper thread, a shuttle carrying an under thread, and a so-called "baster plate" carrying and moving forward the vertically suspended cloth. This machine could sew a straight lock-stitch seam, but it had one fatal defect—the want of a suitable "feed." Howe had been a mechanic from the age of six, when he had gone to work sticking wire teeth in cards for cotton mills. He also came of an inventive family. Although he later developed a practical sewing machine and was undoubtedly the first to solve the fundamental problems of the industry, he reaped little financial reward for his lifetime of effort. He never seemed able to secure financial backing for the actual agencies of manufacture; and, although later in his life, he received large sums from subsequent inventors manufacturing their machines under a royalty for the use of his appliances, lawsuits carried on in defence of his patents swallowed these sums and he lived and died in actual poverty.

The two early machines to be manufactured and achieve commercial success were the products of Connecticut factories. They were the "Weed" and the "Wheeler and Wilson." In 1847, while Howe was still struggling with the problem of a "feed" for his machine,

Allen B. Wilson, then working at his trade as a journeyman cabinet-maker in Adrian, Michigan, conceived the idea of a sewing machine. It is said that he had never heard of one or even knew that anybody had ever attempted to make such a thing. He completed the drawings of his projected machine in the latter part of 1848, at which time he was working at his trade in Pittsfield, Massachusetts. Having obtained from his employer the privilege of working for himself evenings at the shop, he commenced the construction of his first model machine February third, 1849, and completed it in about sixty days. Although not a practical machinist and unable to procure suitable tools, he made with his own hands every part of the machine, whether of wood or metal. The workmanship, therefore, was rather crude, but the machine sewed, and with it were stitched dress-waists and other articles to test its capacity and demonstrate its practical value. This machine contained, as essential parts, a curved eye-pointed needle, a two-pointed shuttle making a stitch at each forward and at each backward movement, and a two-motion feed. This "feed motion" consisted of a serrated bar, which was horizontally reciprocated and, being constantly in contact with the cloth, moved the material forward at the proper time by the forward inclination of the teeth, and receded while the material was held in position by the needle before the latter was withdrawn therefrom. This was the first machine ever constructed that contained a device answering to any extent the requirements of a feed that would enable the operator to control at will the direction of the stitching, and thus to sew continuous seams of any length, either straight or curved, and to turn corners at any angle. In May of

the same year, at North Adams, Massachusetts, Wilson built another machine on the same plan, but of better construction. The United States patent for this machine was issued to him on November twelfth, 1850.

As this machine possessed certain defects, Wilson, in his endeavors to improve upon it, produced a machine in which the shuttle was replaced by a rotating hook and reciprocating bobbin, and a segmental screw-feed took the place of the two-motion feed. For this machine, a patent was issued, bearing the date of August twelfth, 1851, the same day on which was issued to Isaac M. Singer a patent for his first sewing machine. Still dissatisfied with his product, Wilson devised a machine with rotary hook and stationary bobbin, for which he obtained a patent June fifteenth, 1852. This last machine contained another important improvement, which Wilson described but did not claim in his application for the patent, but for which he obtained a patent dated December nineteenth, 1854. This improvement was the celebrated four-motion feed which, in some form or other, has been adopted by almost all sewing machines. This supplied the last element requisite for a thoroughly practical sewing machine suitable for general use, and conformably with Wilson's devices, there were constructed the first sewing machines to be introduced into families, and made suitable for certain branches of manufacture.

In December, 1850, Nathaniel Wheeler, who was at that time a member and the manager of the firm of Warren, Wheeler & Woodruff, manufacturers of small metallic wares at Watertown, Connecticut, became interested in Wilson's inventions, having seen one of his earliest machines on exhibition in New York City. The

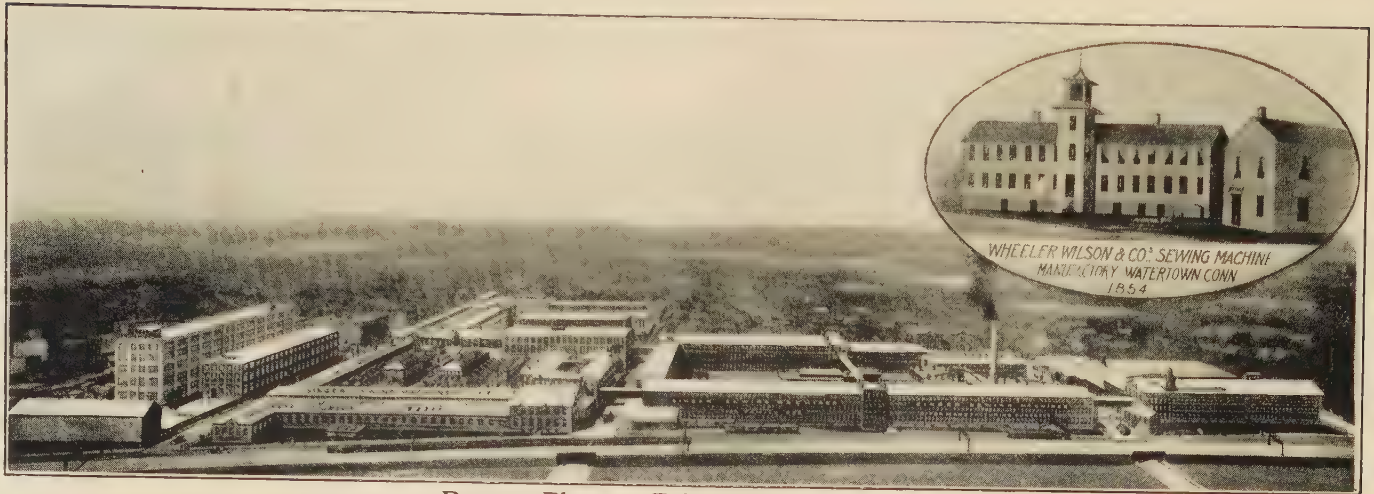
patent for this machine was at that time controlled by E. Lee and Company, of New York, with whom Wheeler, foreseeing the commercial possibilities of the invention, entered into an agreement to build 500 machines in his firm's factory at Watertown and engaged Wilson to act as superintendent in their manufacture. For reasons which it is unnecessary to recount, relations with the New York concern were soon terminated and the contract was never performed; but Messrs. Warren, Wheeler, Woodruff and Wilson formed a co-partnership under the familiar Connecticut name of "Wheeler, Wilson & Company" for the purpose of developing Wilson's inventions and for the manufacture and sale of sewing machines embodying his devices. They manufactured the original "Wheeler and Wilson" machine with the mechanical features which have been described. This became a thorough success, not only in the household, but in light manufacturing.

How it fought its way into manufacturing circles is interesting. Early in 1852, Wheeler took one of the machines to O. F. Winchester of New Haven, who was at that time a manufacturer of shirts. Winchester was so skeptical that he refused even to try "the contrivance," but when Wheeler actually caused a shirt to be made with the machine in his presence, operated by the wife of the inventor, skepticism gave place to wonderment. The speed and perfect workmanship developed led Winchester to consent to take some on trial. Within two months he had purchased the patent rights for New Haven County. Soon after Wheeler took two more machines to Troy, New York, and left them with J. Gardner, a shirt manufacturer there, who after three weeks' trial hastened to Connecticut to purchase rights.

By similar activities of Wheeler the machines were shortly introduced in New York, Boston, Philadelphia and other large cities, and the business placed on a solid basis of prosperity. The Parker Shirt Company of New Britain, established in 1847, purchased one of the very earliest of the Wheeler and Wilson machines. The firm was succeeded in 1853 by a joint-stock company, the Wheeler and Wilson Manufacturing Company, Wheeler holding the presidency as long as he lived.

Upon the organization of the Wheeler and Wilson Manufacturing Company, Wilson, who was solely an inventor and lacked Wheeler's ability to organize companies and market products, retired from active participation in the affairs of the concern, but continued to receive a liberal salary without rendering personal service. He was amply rewarded for his inventions. Of his rotating hook and stationary bobbin, it has been declared by high authority; "They constitute an invention as absolutely original, ingenious and effective as any to be found in the whole range of mechanics, and which has never failed to excite the unqualified admiration of competent experts." Wilson was born at Willett, Cortland County, New York, October eighteenth, 1824, and died at Woodmont, Connecticut, April twenty-ninth, 1888.

In 1856 the company removed from Watertown to Bridgeport and took possession of the factory that had been occupied by the unfortunate Jerome Clock Company, referred to in the chapter on "Clocks and Watches." Soon after this removal a proposed increase of the capacity of the plant from twelve to twenty-five machines per day called for larger space and more capital. When these changes with estimate of cost were



Present Plant at Bridgeport, Connecticut,
Now Factory No. 10 of The Singer Manufacturing Company.

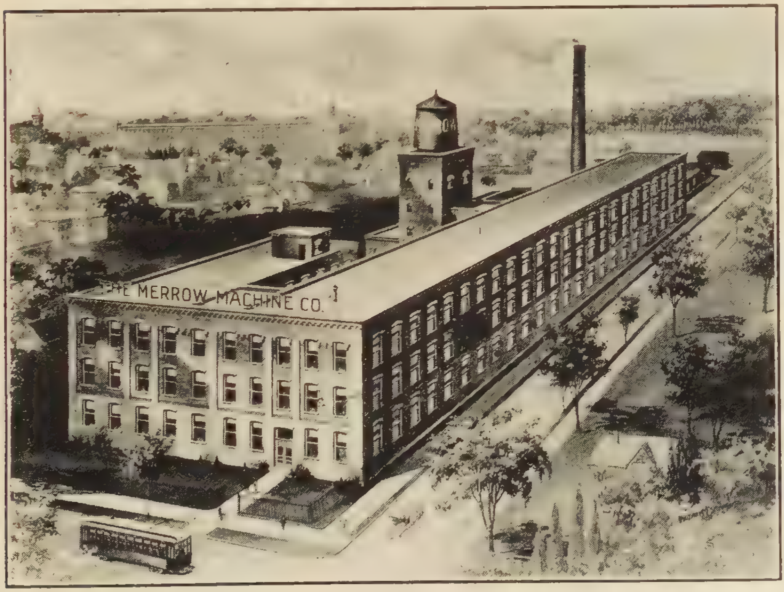
submitted to the stockholders, the expenditure of several thousand dollars was at first proclaimed to be utterly reckless; but finally they decided to take the chance. Wheeler assured them that their company would now be in a position to supply the demands of the whole world! By 1864 the company was capitalized for $1,000,000. As has been stated elsewhere, the rapid growth of this concern has been considered a determining factor in the growth of Bridgeport, which until the arrival of the Wheeler and Wilson concern was an obscure town. The plant now covers 15 acres, including machine factories, needle factory, cabinet factory, and a foundry. For many years the company built but one form of machine, substantially that originally placed on the market, but in the past forty years machines for specialized work of scores of types and hundreds of variations have been produced.

In 1905 occurred in connection with this old Connecticut concern another of those changes which have been elsewhere described as marking one of the latest phases in the evolution of the industries of the State. That was the merger of the old Wheeler & Wilson concern with the world-wide Singer Manufacturing Company, since which time the Bridgeport-made machines have been marked with the latter name. Under the Singer management, the manufacture of sewing machines for family use has been discontinued in the Connecticut factory, the plant being devoted to machines for factory purposes, such as buttonhole, hemstitch, embroidery and multiple needle machines. Through the worldwide Singer selling organization, the machines made at the Bridgeport factory are to be found wherever there is cloth to sew or leather to stitch. But it was not always

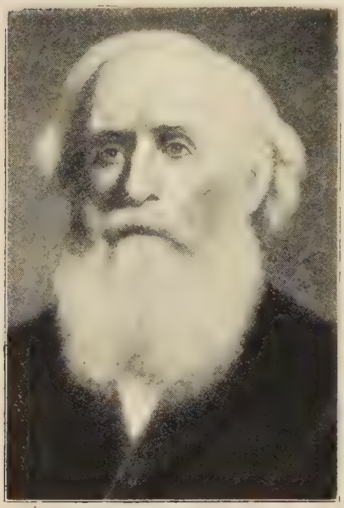
so easy to market this now indispensible product as at the present time. The time was, when it was necessary to deliver sewing machines from Bridgeport to New York secretly to avoid violence at the hands of misguided champions of the rights of labor who, actuated by the same spirit which inspired a French mob to destroy Thimonnier's machines, feared that the introduction of such a labor saving device would destroy the occupation of seamstresses. But that ancient economic fallacy has been again answered, and where there was one seamstress employed at that time in her limited field, there are now hundreds of operatives using highly-perfected machines on a much wider range of work and at distinctly higher wages than those stitching by hand ever earned.

In the quaint old book "Great Industries of the United States," frequently referred to, it is stated that the G. F. Weed machine, manufactured in Hartford for many years, was the most popular of the early models. Awarded the highest prize at the Paris Exposition of 1867 and other similar distinctions it was popular for the simplicity of its construction, and the ease with which it could be operated. Its needle "could be set without a screw driver or other tool," and it was quiet. The most famous of the Weed models was the "G. F. Weed," commonly called the "General Favorite Weed" but in reality so designated from the initials of its designer, George Fairfield, superintendent of the Weed works. This was apparently the first really quiet machine, the noisy appliances being replaced by a swinging or rocking motion which avoided the grinding of cams and clatter of cogs and gears. At the height of its popularity, it is claimed that this company turned out nearly 2,000 machines a

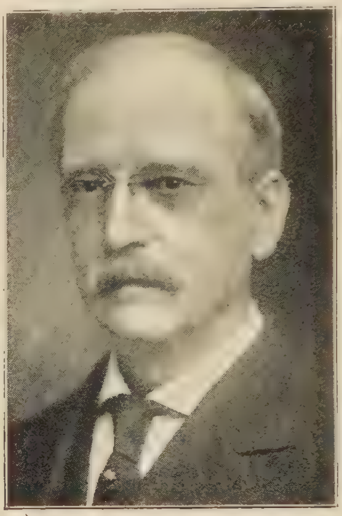
Knitting factory and machine shop of J. B. Merrow & Sons, Merrow Conn., as it appeared before a fire which completely destroyed it in June, 1887.



Present factory of the Merrow Machine Company, No. 28 Laurel Street, Hartford, Conn., built in 1895, as it appears today with several additions.



JOSEPH B. MERROW,
Director-President, 1894-1897.
Died July 25th, 1897.



JOSEPH MILLARD MERROW,
Director 1894 to date. Treasurer 1894-1898. President

GEORGE W. MERROW,
Director 1894 to date. Secretary 1894-1912. Treasurer 1898-1919.

WILLIAM H. STEDMAN,
Director-Superintendent 1894 to date

day. It is regrettable that a fuller history of this famous machine and its makers has not been made available to the author.

Sewing machines were also made, even earlier than the hey-day of the Weed popularity, in Meriden by the versatile Charles Parker Company which at that time had factories to manufacture a great variety of different articles, large and small—coffee mills, plate wares, guns, hardware, as well as sewing machines. The latter product called the "Parker" was manufactured under the patents of Howe, Wheeler and Wilson, and Grover and Baker. It was a double lock-stitch machine and therefore destined to be short-lived. Like all the double lock-stitch machines, it used six yards of thread to each yard of stitching.

Although the Weed machine has departed from Hartford, there are in the city two manufacturers of special sewing machinery, the Merrow Machine Company and the Smyth Manufacturing Company. The Merrow Machine Company manufacture the "Merrow High Speed" over-seaming, over-edging, crochet and shell-stitch sewing machines. They are used by manufacturers only for seaming, hemming, and edge finishing knitted underwear and sweaters, for stitching clocks and seams of hosiery, and similar purposes. The company owes its origin to a knitting business started in 1838 by Joseph Makens Merrow of Hartford, who acquired a property about twenty-five miles from the city where there was a water power. The village which grew up about the mill was called "Merrowville," later "Merrow." This little plant is believed to have been the first knitting mill built for water power. At the mill was developed, a crocheting sewing machine for finishing the edges of the half-hose

and underwear made there. Further experiments developed the present shell-stitch crochet machines, which are unique. Several of the early models were built at the mill and the owners became so interested in the project that, when the mill burned in 1887, it was decided, upon rebuilding, to confine operations to the development and production of the new machine and discontinue the knitting industry entirely. The company was located for a few years in Norwich, but came to its present location in Hartford in 1894. The modern machines embody the inventions of Joseph M. Merrow and his associates. The company maintains branch sales and service offices in the principle textile centers of this country and abroad.

The infectious character of industry has been repeatedly noted throughout this volume. It came naturally about that Hartford, a one-time center for book publishing, should develop the industry of book-making machinery. The representatives of this line have been the Smyth Manufacturing Company and the Sigourney Tool Company. The Smyth Manufacturing Company came into being when its articles of association were drawn up in 1879. Its first president was George Wells Root of Hartford, and its Board of Directors, seven in number, were men whose names have been closely linked with the history and development of the city. The company purchased from George Wells Root and Orianna Smyth a patent for an improvement in book-sewing machines which had been issued to Root in 1879. The mechanical principles involved in this patent constituted the first evidence that a book-sewing machine of practical efficiency could be developed.

The first few machines were built in various shops in

Austin Organ Company, Hartford, Conn.

Hartford under the supervision of David McConnell Smyth. Difficulties were experienced in manufacturing them in this way and the company encountered considerable discouragement in attempting to introduce them to the trade. Even the most progressive bookbinders in the country were of the opinion that machine sewing was impractical, and it was only by installing machines at the customer's terms that this belief could be overcome. One of the first was supplied to The H. O. Houghton & Company of Cambridge, Massachusetts, to sew an edition of 50,000 volumes of the "United States Postal Guide," on the understanding that the Houghton concern would incur no expense through this installation other than the payment of freight on the machine.

In 1880 John R. Reynolds took charge of the building and perfection of the machine, the work being now done by the Sigourney Tool Company, a concern also owned by George Wells Root. The fact that the machines were now all built under one roof and that Reynolds effected many improvements in the design of the machine, was reflected in increased sales and more rapid production. The bookbinding trade found that the apparently impossible had been accomplished, and that the machines were a necessity in successful competition. In 1898 the Smyth Manufacturing Company acquired control of the Sigourney Tool Company and thereby became owners of their manufacturing plant. At first sewing machines only were manufactured, but gradually other devices for use in bookbinding were developed—such as machines to apply the finished cover to the sewed book, gluing and pasting machines, machines which form the backs of the book covers, and a large three-knife machine to trim three sides of a

sewed book at one operation. These Smyth machines are to be found wherever books are made. They have been a particularly important factor in the development of modern "editions" and in school-book publishing.

Musical Instruments

Another branch of industry in which Connecticut concerns have achieved distinction is the manufacture of musical instruments—particularly those devices for reproducing the tones of human voice and for the mechanical operation of the piano which have come into vogue during the last few decades. The manufacture of musical instruments in Connecticut is not a new industry. There was a well-known piano manufacturer in New London quite early in the nineteenth century, N. B. Smith. The small graceful products of his labor are generally called "spinets," but were undoubtedly actually pianos or melodeons. In New Haven by the middle of the last century the Teat & Lindsey melodeons were well known. The State has also become a leading manufacturer of piano and organ parts and accessories. Along the lower Connecticut River there have grown up and flourished for many years important factories for the manufacture of ivory piano keys, organ stops and knobs, keyboards and other parts for musical instruments of that type. Pratt Read & Company has two factories for this purpose located at Deep River and Comstock Cheney & Company operate a large factory at Ivoryton in the town of Essex, the village having been named from the industry. These two concerns stand among the leaders in the country in their line. The Cornwall & Patterson Company of Bridgeport are also large manufacturers of piano and organ hardware.

Hall Organ Company, West Haven, Conn.

The Austin Organ Company of Hartford is the largest pipe organ factory in the country and has built many magnificent organs for famous public buildings and churches, notably the organ in the Public Ledger Auditorium presented to Philadelphia by Cyrus H. K. Curtis and reputed to be the largest organ in the world. This company was organized and located in Hartford in 1899 to build organs equipped with the "Austin Universal Air Chest," invented and patented by John T. Austin, now president of the company. This air chest is designed to eliminate the "robbing" or wind variation, which is manifested in ordinary organs, and presents a steady volume of tone. Under Austin's device, absolute and unvarying pressure of air is produced, so that the tone is always under control of the musician. The company has built nearly 1,000 organs on the universal air chest system, confining itself only to large instruments. It produces none with less than three keyboards or "manuals" adapted for use in large churches and public buildings. The huge Philadelphia organ just referred to has 4 manuals and 283 stops!

The Hall Organ Company of West Haven, organized in 1898, also manufacture pipe organs, for churches, theaters and public halls.

But, as has been said, the State's peculiar distinction in this general line has been in the production of what might be termed "mechanical" instruments.

Undoubtedly the most familiar of these are the products of the Columbia Graphophone Manufacturing Company in Bridgeport. In 1877 a Frenchman, Charles Cros, submitted to the *Academie des Sciences* in Paris a talking machine that was apparently never developed. In the same year, Thomas Edison filed his

patent for the phonograph which, as all the world knows, became completely successful. During 1877 and 1878 in laboratories in New York and Washington the device was being perfected. In 1886 Edward D. Easton formed the Columbia Phonograph Company as a selling agent for the North American Graphophone Company. The American Graphophone Company of West Virginia had been formed in the meantime, founded on patent licenses from Bell and Taintor, and somewhat later, in 1869, Taintor started a small factory in Bridgeport to manufacture the new invention. Easton's company was selling agent for both. Later, Easton's concern, The Columbia Phonograph Company, undertook the manufacturing end also, and built great factories for this purpose in Bridgeport.

The first talking machines were hand-operated by a crank. The method soon gave way to a treadle, or an electric motor driven by storage batteries; and finally, T. H. MacDonald of the American Graphophone Company invented a clock-working machine driven by a steel spring, a method of rotating the disc plate which is still in use except in the electrically-driven machines. The records also passed through similar developments. The first was a cylindrical paper core with a tinfoil surface; following this, a paper core dipped in wax; and, finally, the modern hard-rubber compound, consisting of a flat disc instead of the original cylinder. The use of both sides of a disc, known as the "double disk" records, was originated by the Columbia people, and is now used by all makers of phonograph records. The daily record production of discs by the company was at one time as high as 325,000, and now varies from 125,000 to 200,-000. The Columbia Company was the victim of over

HARTFORD FACTORIES OF THE HART AND HEGEMAN MANUFACTURING COMPANY.

Main Works and Office

South Work Plant

expansion during the World War and has not recovered from the resulting depression. The production of machines and records has, in consequence, been much curtailed. In spite of these conditions, however, its average number of employees ranges from 3,000 to 4,000. Along with its talking machine, the company has developed a device called the "dictaphone." This is an office appliance, now well known, whereby letters, or other facts to be recorded, are dictated to a cylinder which, when placed on another machine, will reproduce the words to a typist for transcription.

The second form of mechanical instrument in which the State has been a notable producer is the piano-player. This is the well-known "Angelus," manufactured by the Wilcox & White Company of Meriden. According to the United States census report, the first piano-player was conceived in that city. The report says: "In 1895 Messrs. Wilcox and White of Meriden, Connecticut, began manufacturing an interior attachment, 'Angelus' cabinet piano-player. This instrument, the inventor, E. H. White, may be regarded as the pioneer of the various similar attachments which have since been placed upon the market." The Wilcox & White Company, which since 1877 had been builders of pianos, reached the conclusion near the end of the last century that the piano had been developed to a point approaching perfection. Its officers, therefore, directed their attention to the discovery of some method by which its music could be produced mechanically. The first successful attempt took the form of a separate cabinet instrument, looking somewhat like a small closed organ, which was placed in position before the piano. Its mechanical fingers, coinciding in spacing to the keys of the piano, actually played

the instrument. This form was adopted largely because the inventors felt that the new attachment would appeal for the most part only to those already possessing pianos. The popularity of this first attempt showed that many people, unable to play themselves, desired to purchase pianos to be played mechanically. Thereafter the mechanism of the automatic player was incorporated within the case of the piano, rather than placed in front of it. By means of various devices on the keyboard, means were provided for interpreting the composition to suit the player, for the independent control of bass and treble, for emphasis of the melody proper, and for control over tempo and volume. This gave to the operation of the player control over the musical production. The next step, however, was to develop a recording and reproducing device that would render the selection, not as interpreted by the individual operator of the mechanical player, but as actually played by the great pianists of the day. This precision of artistic interpretation is the boast of the manufacturers, in the production of their latest device, called the "Artrio Angelus." The Wilcox & White Company recently merged with the Hallet & Davis Piano Company of Boston, makers of pianos since 1835.

Electrical Products

As we have followed the inspiring, and in many respects romantic, story of Connecticut industries we cannot fail to have been struck by the amazing adaptability of its manufacturers to changed conditions. No more characteristic example of this may be found than that afforded by electricity. In the chapter on "The Development of Power," we have seen how the Hartford Electric Light Company was the pioneer, not only in the

THE HARTFORD FAIENCE COMPANY, HARTFORD, CONN.

State, but in the Nation, in the sale of power in large quantities and at a minimum rate to industrial plants; and in the chapter on "Tools and Builders' Hardware" we have seen how the great New Britain concern of Landers, Frary & Clark, seized upon the applicability of electrical power to household appliances and has established its widely diversified line and built up its vast business by this same adaptability. It remains in this connection to chronicle the accomplishments of some of those concerns which have been the developers, makers and distributors of strictly electrical products.

The pioneer in this line was the Bryant Electric Company of Bridgeport; and it has since become the largest plant in the world devoted to the manufacture of wiring devices. It was established in 1880 for the production of the "Bryant Push and Pull Switch," invented by W. C. Bryant. Other wiring devices were later added to this product, and in 1889 additional capital was secured and the company was incorporated under its present name. At one point in its history, the name of P. T. Barnum, already familiar in connection with other industries, appears; for it was from him that the company leased the old school house which it used as a factory, prior to its location upon the site of its present plant. In 1900 the company purchased the Perkins Electric Switch Manufacturing Company of Hartford and moved the business to Bridgeport. Its factory floor space is now over 500,000 square feet.

Another early company in the industry which has grown to importance and prominence is the Hart & Hegeman Manufacturing Company of Hartford. This concern, founded by Gerald W. Hart and George S. Hegeman in Kansas City in 1890, was moved to Hart-

ford shortly after its organization to be near the sources of electrical supplies and skilled labor. From its small beginnings the company has grown to be what is generally considered the largest manufacturer of electrical switches in the country. In 1922 the concern was consolidated with the H. T. Paiste Company of Philadelphia, manufacturers of other electrical wiring devices. During the World War the company supplied switches controlling electric gun-firing apparatus, and other devices which would afford unbounded amazement and interest to Eli Whitney and other early Connecticut munitions makers, but which are taken for granted as of merely passing interest in the multitude of other miraculous products of the electrical art.

Another prominent electrical concern of Hartford is the Arrow Electric Company, which has its principal office and factory in that city. Organized as The Perkins Corporation in 1905, the company's first product was push button switches. The name was soon changed to the Arrow Electric Company and its capitalization rapidly increased, being at present $2,400,000. By purchase of the Marshall Electric Company, makers of sockets and miscellaneous wiring devices, the Arrow Company greatly increased the variety of its output, manufacturing now between two and three thousand different devices. Very recently the Washington Porcelain Company, manufacturers of porcelain having about 300 employees, was purchased, the entire output being consumed by the Arrow Electric Company. Its varied products are marketed in the United States and other countries.

The mention of porcelain for use by the Arrow Electric Company leads naturally to The Hartford Faience

Company. This concern, originally organized in 1894 to make faience and tile, soon discontinued its early product in favor of electrical porcelain. This came about in response to a demand on the part of the growing electrical manufacturers in Hartford. The plant, employing about 200 hands, disposes of its entire output to these local concerns.

The Trumbull Electric Company of Plainville, is another concern that, by superior application and business acumen, has risen to power and prominence on the great electrical tide. Beginning in Hartford in 1899, with a capital stock of only $2,000, it at first manufactured ceiling rosettes under its own patents. Its plant was soon moved to Plainville. Other porcelain wiring devices were added to its output—panel boards and switchboards, and also open-type knife switches, in which line the company became one of the leaders in the electrical world. About five years ago an increasing demand arose for enclosing the open-type knife switches, and the Trumbull Company seized the opportunity and began to specialize in safety switches, which now comprises more than half of the total output of the company. The concern employs about 500 workmen.

Another company making a specialty of safety switches is the Trumbull, Vanderpoel Electric Manufacturing Company of Bantam, established in 1912. It has discontinued its former manufacture of switches and panelboards and now produces only enclosed and knife switches. Electrical switches and control apparatus were formerly ordinarily constructed with the charged parts exposed. With the extension of the "safety-first" movement, this type has been largely replaced by devices which afford full protection to the employee in

operating and repairing them. The Trumbull, Vanderpoel Electric Manufacturing Company has marketed several such devices, particularly the "Mason Safety Switch" which provides not only for safe operation, but assures safety in inspection or replacement of fuse links. This type of switch has also been developed for residences ensuring safety for the householder in replacing fuses.

Returning to the Bridgeport section, there are several other electrical manufacturers to be there mentioned. Two manufacturers of electrical specialties are Harvey Hubbell, Incorporated, of Bridgeport, prominent makers of electrical machine screws and other devices; and the Electric Specialty Company of Stamford, manufacturers of electric motors, generators and dynamos. The latter company has developed motor generators for wireless operation, generators for motors for electrical musical instruments, notably noiseless piano motors, electric bottle washers, and polishing, buffing and grinding motors. During the war this company developed, operating under government supervision, special motor generators for wireless communication for aeroplanes and war vessels. One of the later comers into the field of electrical manufacture is the Veco Manufacturing Company of South Norwalk, established in 1921, which produces aluminum electrical devices.

The wide range of the application of electricity to household uses has been referred to in the account of the great concern of Landers, Frary & Clark of New Britain. An interesting development of a somewhat similar nature is the pioneering of the Automatic Refrigerating Company of Hartford in the field of electrical refrigeration. This company was the originator

THE TRUMBULL-VANDERPOOL ELECTRIC MANUFACTURING CO., BANTAM, CONN.

View from South

Original factory 1812

View from Southwest

and for many years the only manufacturer of automatically controlled, mechanical refrigerating plants. These were such radical changes in the art of mechanical refrigeration that some manufacturers ridiculed the possibility of automatic devices being able to start and stop the machinery at the proper time, to automatically control the flow of the refrigerant to the cooling coils, the flow of water to a condenser and to automatically stop the operation of the plant in case of excessive pressures arising through some external cause. But time has amply justified the early efforts of the engineers of the Automatic Refrigerating Company. In addition to its commercial line of ammonia refrigerating plants, it has developed a machine for small installations, using only atmospheric air as a refrigerant and doing away entirely with the use of any kind of mechanical refrigerant. The design of this machine is on entirely new lines and it is one of the first efficient and economical air refrigerating machines. The Automatic Refrigerating Company was the only concern manufacturing refrigerating machinery to be awarded the Grand Prize at the Panama Pacific International Exposition at San Francisco in 1915.

Another avenue of domestic life into which electricity has entered is that once occupied by the torch, then by the tallow candle, later by the oil lamp, and still later by the illuminating gas. The first three of these methods of illumination have largely disappeared in the United States—chiefly on account of the simplicity, practicability and cheapness of electricity, for lighting purposes.

One of Connecticut's oldest manufacturing organizations—makers of lamps—has kept pace with this

change in the lighting habits of the nation. The Miller Company of Meriden does an extensive domestic and foreign business in the manufacture of household and commercial electric lamps. This concern was organized in 1844, by Edward Miller for the manufacture of whale oil lamps. In 1855 the company manufactured the first kerosene oil burners ever made and which were invented to utilize the natural oil discovered in Pennsylvania in that year. The company survived a disasterous fire in 1856 and the panic of 1857, its business continuing to grow. Edward Miller began the manufacture of kerosene burners in 1858, and was the first manufacturer in America to perfect and market burners using kerosene oil obtained from distilled coal. A division of the Miller Company manufactures a high grade of light and glass ware, metal reflectors and commercial unit hangers. The Miller Company is one of the country's leading makers of lighting equipment.

It is of especial historical significance that the General Electric Company, probably the largest electrical equipment manufacturer in the world, had its birth in New Britain. It was then called the "American Electric Company." A considerable number of subscribers to its stock were from New Britain, and practically all were from Connecticut. It was organized to put into actual commercial service the Thomson-Houston system of electric arc lighting, then a complete novelty. Elihu Thomson and Edwin J. Thomson, professors of physics in Philadelphia, developed the three-phase dynamo, in connection with experimental work undertaken by the Franklin Institute in that city. The two Philadelphians started the business in their own section, but the American Electric Company, with which Pro-

The Plant of the Automatic Refrigerating Company, Hartford, Conn.

fessor Thomson had cast his lot, took the New England district. E. W. Rice, then a lad in his 'teens, accompanied Professor Thomson to New Britain. He later became president of the General Electric Company. Unfortunately the Connecticut career of the concern was not successful. It is said that the policy adopted was not broad, and that financial backing sufficient to develop a product of such an experimental character was not forthcoming. The majority interest in the company was sold to the Brush Electric Company of Cleveland. As a result of a small exhibit of lights in Boston, several Lynn manufacturers, who were interested in the new electric street lighting possibilities and desired to introduce arc lights into their city, were attracted to New Britain. There they became enthusiastic about the possibilities of the young languishing enterprise, and its brilliant leaders. They thereupon formed a syndicate of Lynn manufacturers, who provided the stock and secured for themselves the services of the inventors. For a while the New Britain factory was run under the name of the Thomson-Houston Electric Company, but the business was soon removed to its present Massachusetts headquarters at Lynn. Its subsequent growth and its merger with the Edison General Company under the now internationally-known General Electric Company, is a part of current history. The intimate connection of this great company with Connecticut in its early days has been kept up by its recent acquisition of large and prosperous concerns producing electrical appliances in the State.

The electrical field does not, of course, possess the long lineage and picturesque beginnings of other lines, such as clocks, silk, silverware and tools. Its industries

have been founded and grown to maturity during the lives of many men now living; but it has been necessary, and has, it is hoped, proven of interest to give this running account of the State's more outstanding concerns in this line.

Marine Engines

In addition to its surviving shipyards, Connecticut to some extent maintains its maritime traditions by the presence of two manufacturers of marine engines. The explosive type of engine, invented by Otto, was, like the later Diesel, of German origin and was brought to this country about 1870, being introduced in Philadelphia at that time. It used a mixture of illuminating coal gas and air for fuel. The inventor of the Diesel engine was Rudolph Diesel, a German engineer who conceived the idea of an internal combustion engine giving sufficient heat for ignition purposes by compressing pure air only; the fuel to be burned to be admitted only after compression had taken place, and then, due to the intense heat conditions in the cylinder, to burn as fast as supplied to the cylinder. He believed that an engine working on this principal would be both economical and efficient, and the subsequent development of the mechanism has amply justified his belief. It is considered to be, on the whole, the most economical prime mover known. The first Diesel engines as used in Germany were for stationary engines, but the Russians soon applied them to their river boats, since they had heavy river traffic and a plentiful supply of oil. The original engine was fitted with an arrangement of clutches and gearing. By 1910 a seagoing vessel had been successfully so equipped, other large vessels following suit.

The Factory of the Miller Company Meriden, Conn.

Palmer Brothers Engines, Incorporated, of Cos Cob was the earliest manufacturer, not only in Connecticut, but in New England, of gasoline marine engines. In 1895 this company commenced the manufacture of marine engines in a small way, using gasoline and air as a firing mixture. At this time the only other maker of such engines was a Philadelphia concern, the Globe Company. The business grew steadily and today it has a capital of $500,000 and employs 125 machinists. Prior to the World War, Palmer engines were known and sold throughout the world, wherever power boats of their class were operated for pleasure or business. Since the war, financial conditions in Europe and the rate of exchange have prevented resumption of exportation to the Continent, but Palmer engines are still being shipped to Australia, South America, Canada and other countries not affected by exchange rates. They of course have a large domestic sale. Over 50,000 Palmer engines have been manufactured and sold since the company was organized.

The New London Ship and Engine Company at Groton manufactures engines of the Diesel type. In 1908 the United States Navy Department decided that some means for propelling submarines must be found other than gasoline engines, both on account of the danger of using gasoline in such limited space and also on account of the cost of fuel for engines of the necessary size. A representative was sent abroad who reported after careful study that the Diesel type commonly known as the "M. A. N." (built by the Maschinenfabriks Angsburg-Nurnberg A. G.) was best adapted to submarine purposes. In 1910 the New London Ship and Engine Company was incorporated primarily for the purpose of

producing these engines and the concern is now the largest in the United States engaged in their manufacture. Its plant, occupying a tract of thirty-six acres, consists of administrative building, large machine shop, including coppersmith's pattern shop, and a forge shop and store houses. A gray iron and steel foundry, fully equipped and having a laboratory for various analyses, has recently been added. The engines may therefore be made entirely on the ground, from raw material to the complicated finished product. It has also a marine railway with dry docking service. The company has also built commercial Diesel engines for fishing vessels, tugs, passenger and cargo vessels now operating in both the Atlantic and Pacific Oceans, as well as Diesels of the stationary type for municipal power plants and pumping stations. The company has built many millions of dollars worth of engines for the United States and foreign governments for submarine equipment. Its average yearly business is $1,-500,000 and its number of employees 700.

Brushes

We have seen from time to time that Connecticut manufacturers have owed their distinction as much to their ability in salesmanship as to their skill in production. How Eli Terry made his clocks by hand and packed them upon his horse's back and went out into the countryside to sell them; how the tin-peddlers of Berlin founded the great metal works of New Britain; and how the book publishers of Hartford first developed the now familiar method of selling books by private canvassers have been told in their appropriate chapters. We now come to one of the most spectacular and comprehensive

Marine Railway

Bird's E

COMPANY, GROTON, CONN.

Administration Building

Plant

salesmanship schemes ever developed, in this State or any other. That is the nation-wide factory-to-consumer system of distribution so successfully worked out by the Fuller Brush Company of Hartford.

Seventeen years ago a Nova Scotia farmer boy with $75 in his pocket, earned the previous summer on a near-by farm, arrived in Boston to seek his fortune. Apparently he did not look in the right places, for his first three employers dispensed with his services in rapid succession: a street car company, because he ambitiously attempted to run the car while still only a conductor; a wealthy resident of Somerville, because he forgot to curry the old white horse and the family returned after a drive "looking as if they had been out in a snowstorm;" and an operator of a line of express wagons, who dispensed with his services "with mutual consent and relief."

Meantime the Nova Scotian, who was Alfred C. Fuller, had had his attention directed to a small company which made brushes on the "twisted-in wire" principle and had been founded by a brother who had recently died. He found employment with the purchasers of his brother's enterprise, as a salesman of the four or five varieties of household and personal brushes which they manufactured. Determined to found a similar business of his own, at the end of a year's time with savings of $375, he set up a little workshop in the cellar of his sister's home in Somerville, with a "hand twisting machine" purchased for $15, thirty or forty dollars worth of wire and bristles, and a big pair of scissors for trimming purposes. The "workshop" consisted of a little bench 15 feet long over which he rigged up a gas light. The warehouse was a corner of the attic. His

knowledge of the manufacture of brushes was limited to the occasions on which he had watched the men at work in the plant. After some experimenting and study he made a product that suited him, and established his routine. In the forenoon he took his sample kit and solicited orders from door to door; in the afternoons and evenings he manufactured, working sixteen to seventeen hours a day.

Within a few months he felt justified in moving his little enterprise to Hartford, as the center of a territory less supplied with brushes than the environs of Boston. For $11 a month he rented shop space in a shed built onto a storage warehouse, and lived in a room nearby and proceeded as before. When he was making $40 a week he hired a man to "manufacture" and devoted his entire time to selling—first in the vicinity and soon throughout the country.

As he developed each territory, he secured an agent and located him there to maintain it. By this simple process the enterprise grew. Through national advertising he secured more salesmen, still following his door-to-door method and paying liberal commissions. The variety of brushes manufactured was also increased rapidly. By means of the personal contact with housekeepers and their needs, he learned to adapt his output to the market, rather than follow the beaten paths. Floor mops that would slip under radiators, chemically treated dusting brushes with handles and numerous other convenient innovations were largely inspired by the housekeepers themselves.

More recently a line of brushes for toilet use has been added. On account of the varied uses of the brushes, some of which serve several purposes, it was early de-

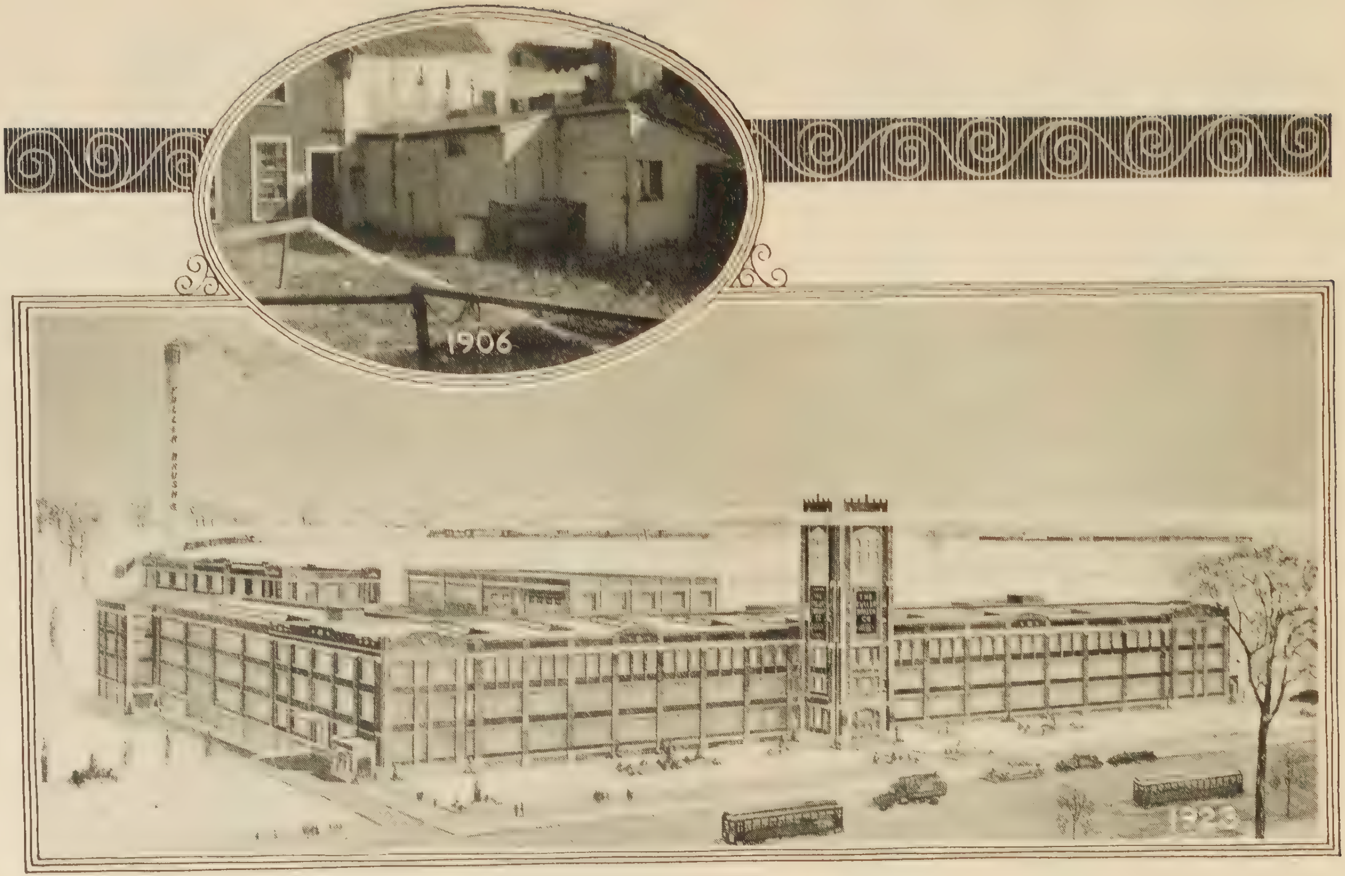
cided to continue permanently the policy of direct sales. The retail clerk could not learn the "selling points" of the product as thoroughly as the agent with whom the brushes were his sole stock in trade. Undoubtedly it is due to this method and an amazing system of modern advertising, that within fifteen years the little basement enterprise has become a great manufacturing and selling organization. The Fuller Brush Company, with its half million dollar factory, its 2,400 salesmen, its total annual sales of over $10,000,000 has become the largest manufacturers of brushes, dusters and mops in the world! The company now has 251 offices established throughout the United States, Canada and the West Indies, by which the agents in the surrounding territories are managed. Its large sales have been credited to the unusual method of remunerating its salesmen. Each has his exclusive territory, is paid a liberal commission, and is inspired by a rapid system of promotion. All executive officers are promoted from within and all are on a profit sharing basis, for there is no "outside money" in the company; the personnel makes and receives it all. The entire construction and success of the Fuller Brush Company is unique and, its product a household by-word.

Heavy Mill Machinery

Another prominent Connecticut concern whose career possesses unusual historical value is the Farrel Foundry and Machine Company of Ansonia, builders of heavy mill and factory machinery. While this company is a very large maker of machines, it should be distinguished from the specialized concerns treated under the "machine tool" group. It was organized in 1848 by Almon Farrel and his son, Franklin Farrel. In our chapter

on "Power—Its Production, Transmission and Use," we refer to the various steps taken in the art of transmitting power within the limits of the plant itself, and it is interesting to note that the first machines produced by the Farrels were power-drives and gears for installations running by water power. In the early days, young Franklin used to set out on horseback and canvass for orders for machines. He would then return and borrow from the bank sufficient capital to carry on the manufacturing processes to fill the orders, during which period he would take his place at the bench as a workman. Like so many of the founders of Connecticut industries, he was both a salesman and a mechanic. He evidently was also a financier. Many of the early machines were delivered by heavy ox-teams.

The company assumed its present name in 1853. With the start which it had secured in the production of power drives and gears, it was not long before the company commenced to build rolling mills, calendars, and and other roll-operating mechanisms. It was natural that this department of the company's business should be developed in the Naugatuck valley where the great brass interests were located. An early connection was also formed with the neighboring rubber industry. As shown by Franklin Farrel's diary in 1854, some rubber calendars were then built for Goodyear, the father of the manufacturer of rubber products. At this time, it was necessary to import chilled-iron rolls from Great Britain, but before Franklin Farrel's death the situation had been reversed and the Farrel Foundry and Machine Company was manufacturing rolls for export. Another market which this company found for its products was the paper industry. This was, in turn, followed by the



Main Factory and Administration Building of the Fuller Brush Company at Hartford. Insert shows the Fuller factory in Hartford in 1906

Other manufacturing plants and distributing stations of the Fuller Brush Company and Fuller Brush Company, Ltd., and a few interior views of the factory at Hartford

sugar-manufacturing industry, for which the company began to manufacture sugar mills about 1870. At this time there were several other American manufacturers who were building sugar mills for the West Indies trade, but at the present time the Farrel Foundry and Machine Company is the sole survivor of the group. At about 1890, the company shipped to Cuba machinery for two sugar mills weighing 320 tons each. The chilled rolls were 44 inches in diameter and 7 feet long on the face. Much of its rolling-mill machinery has been the largest manufactured in America. The original products—power drives and gears—are still manufactured, but the company today devotes itself chiefly to the service of the foregoing five basic industries—metal-rolling mills, rubber-mill machinery, paper calendars, and sugar-mill machinery. During the World War, it manufactured gun carriages and shell presses and made the castings for the turbine engines in over 100 United States destroyers.

The little plant started by Almon and Franklin Farrel in 1848 has expanded into a modern industrial group on the banks of the Naugatuck River covering thirteen and one-half acres. The company also has a branch plant located at Buffalo, New York, producing about one-fourth of the concern's output. Although located in the historic valley where huge combinations and re-combinations have been the order of the day, the company has remained an independent corporate entity. The Waterbury Farrel Foundry was originally started as a branch of the Ansonia concern, but is now independent. The name Farrel takes its place in Connecticut industry along with that of Cheney, Chase, Sargent, Wallace, Seth Thomas, and others which have been identified with the establishment of nationally-known industrial institu-

tions; but, as in the other instances, the active management and control have always been kept within the family group. Two of its directing officers at the present time bear the Farrel name. The company is capitalized for $3,000,000 and its payroll shows nearly 1,000 employees. Its products are shipped to all parts of the world.

In Derby, diagonally across the river from the Farrel Foundry and Machine Company, where Anson Phelps at one time entertained his project of establishing an industrial town to be named "Birmingham" after its English prototype, there has been developing for nearly a hundred years, along conservative, substantial, and strictly Connecticut lines, another company engaged in a similar line of business. This is the Birmingham Iron Foundry. Its beginnings antidate its neighbor by twelve years, and it was also incorporated under its present name three years earlier than the Farrel concern.

It was in 1836 that three brothers, named Colburn, came to Derby from Westville, Connecticut, and built a small factory, originally devoted chiefly to the production of coarse castings such as sash weights. Soon afterward, a small machine shop was built and equipped, all of the original buildings being small and of wood construction. Today the plant comprises a land area of seven and one-half acres, well covered with substantial brick, concrete and steel buildings and fully equipped with modern machinery.

When, in 1850, the business was incorporated under its present name, the Colburns practically dropped out and the ownership and control went to Sheldon Bassett. The firm continued under his management until about

FRANKLIN FARREL

Son of Almon Farrel, was born in Waterbury February 17, 1828, and died January 10, 1912. After a common school education he went to work for his father who was a famous millwright, engineer and builder in the Naugatuck Valley. In December 1844, Mr. Farrel came to Derby (now Ansonia) to assist his father in constructing a copper mill for Anson G. Phelps and to lay out a canal to supply the power. In the meantime the Colburns who had established an iron foundry at Derby engaged Almon Farrel to help them in their castings troubles and in 1848 Farrel & Johnson established a foundry and machine business in the village of Ansonia with a capital of $15,000, $8,000 of which was owned by Almon Farrel. In 1857 at the death of Almon Farrel the business was reorganized as the Farrel Foundry Machine Company with a capital of $90,000. Franklin Farrel after representing the company as general manager was made president in 1869 continuing until his death. The capital is now $3,000,000 and its machinery is known throughout the world. About 1877 Mr. Farrel went to Butte, Montana, where he formed the Parrott Silver & Copper Company. In 1889 the control of this company was sold to the Amalgamated Copper Company. Mr. Farrel also became interested in the growing of sugar in Cuba and San Domingo where his improved sugar mills were very successful. These properties were disposed of in 1903. Mr. Farrel was interested in many other enterprises industrial, financial, social and religious. He was twice married. March 31, 1850 he married Julia L. Smith of Derby who died September 9, 1874, the only surviving child being the wife of Col. Rutherford Trowbridge of New Haven; December 12, 1876 he married Lillian Clarke, daughter of Wilson Clarke of New Haven and she survives him.

Franklin Farrel

1890, when the business passed into the hands of the present management. The growth of the concern has been gradual. There have been no failures, no compromises with creditors, no reorganizations, no consolidations or changes of any kind, except in size and capitalization. The chief products of the company at the present time are rubber mill machinery, rolling mill machinery, sheet metal-working machinery, drop presses, heavy machinery generally, chilled rolls, and iron castings ranging in weight up to thirty tons.

During the Civil War this company bore a distinguished part in providing munitions for the Northern armies. It produced machinery for rolling bayonets and gun barrels, and rendered other important services incidental to foundry and machine shop work. During the World War, although not seeking government business, the concern yielded the facilities of its foundry and machine shop very largely to the cause of the Allies when it was required, operating partly through sub-contractors and partly by direct contract. Its relationships were principally with the Watertown Arsenal.

During its long career this concern has made valuable contributions to the production of heavy mill machinery. These have been largely applied to the rubber industry, and some of its machines have practically revolutionized manufacturing processes in this field. It was the first company in Connecticut, and one of the first two or three in the country, to take up the manufacture of the chilled rolls so largely used in rolling mills, rubber mills, paper mills and like plants. The trade mark "Birmingham" is known wherever rubber machinery is used. A noteworthy feature of the growth of this old concern has been its conservative and efficient financing. Although

the present paid-up capital stock of the company is $1,-200,000, with a substantial surplus in addition, there has been paid into the company during the three generations of its career only $90,000 in cash. The institution has grown and expanded out of its own earnings. It employs 450 hands and has an annual volume of business of over $1,500,000.

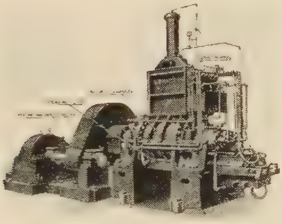
Malleable Iron

An important product entering into numerous lines of manufacture is malleable iron. One of the leading companies, both from a historical point of view and from its present magnitude, is the Eastern Malleable Iron Company, with main office at Naugatuck. This concern is the outgrowth of a co-partnership formed in 1858 by Bronson B. Tuttle and John H. Whittemore. These young men had become interested in a local blacksmith shop and at first undertook the manufacture of iron rakes. This led to experimentation with various kinds of iron. It was largely through their investigations and labors that modern malleable iron was developed and its practicability in a wide variety of uses established.

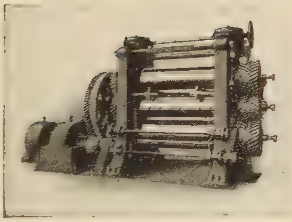
In 1871 the two partners formed themselves into a company known as the Tuttle and Whittemore Company. In 1899 this was succeeded by the Naugatuck Malleable Iron Company. In the meantime, in 1877, the Tuttle and Whittemore Company had purchased the plant of Hubbell, Walker & Gill, a small one-story structure in Bridgeport employing about twelve molders. They also acquired a plant at Troy, New York, and the Vulcan Iron Works at New Britain. In 1912, these companies were all merged into the present Eastern Mal-

1

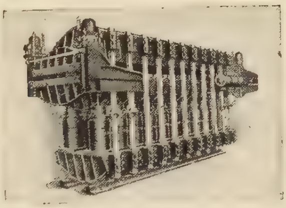
2



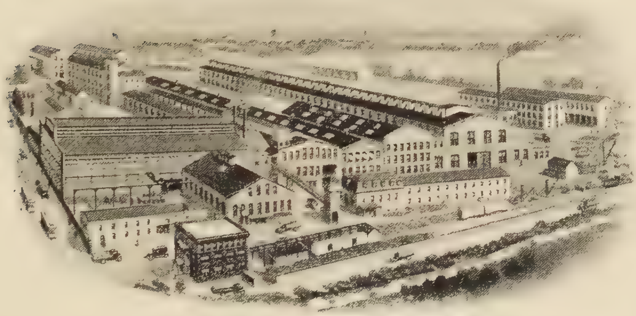
3



4



5



Plant of Birmingham Iron Foundry and Some of its Principal Product—Rubber Mill Machinery

1. Rubber Mill with Motor Drive. 2. 200 H. P. Herringbone Gear Reduction Drive. 3. Banbury Mixer—internal type machine for masticating and compounding rubber. 4. Rubber Tire Calender with Motor Drive. 5. 25′ Hydraulic Belt Press weighing 250 tons.

leable Iron Company. From such small beginnings, large modern plants have grown up in these several towns, turning out certified malleable iron and gray iron castings for use by railroads, the automobile industry, the electrical field, manufacturers of agricultural implements, hardware, and numerous other lines. Here is another branch of industry in which the State has made notable contributions.

Leather Goods

Within the restricted limits of this volume there is little room for philosophy or speculation. Possibly, if sufficient research were made, a reason might be found why the boot and shoe industry localized itself about Eastern Massachusetts, as the brass trade found a domicile in the Naugatuck valley. So far as may be seen, Connecticut had a fair start, and eventually lost out. Some distinction was won in saddlery and preëminence was achieved in belting; but the great volume of the leather trade went elsewhere.

Connecticut, in its Colonial agricultural days, having of necessity a certain amount of live stock, tanned the hides and made therefrom the leather necessities of pioneer life—mostly boots and shoes. At one time New Haven even made shoes for export, the trade being regulated by orders of the courts of Hartford and New Haven as to the quality of the leather. Fines and punishment were imposed on manufacturers apprehended selling inferior product. Norwalk, too, was an important center of this industry in the early nineteenth century. The making of saddles and harnesses was of importance in the early history of Bridgeport and remained a considerable industry in

Hartford throughout the century, until displaced by the automotive avalanche which destroyed the New Haven carriage factory and dealt a serious blow to the famous Capewell Horse Nail factory of Hartford. Smith, Bourn & Company was probably the best known of the Hartford saddlers, the company continuing to manufacture harnesses and saddles as the Smith, Worthington Company. "Patent Leather," the invention of S. J. Patterson of Bridgeport in 1845, lead to the establishment of the Bridgeport Patent Leather Company which flourished in that city for many years.

The most famous leather industry in Connecticut, however, is the Jewell Belting Company of Hartford. This is another of those prominent Connecticut industries with a long and interesting history. In 1770 Asahel Jewell began the tanning of hides in a little log cabin on the banks of the Ashuelot River in New Hampshire, where Winchester, home of many belting companies, is now situated. From the surrounding forests he hewed huge trees and from them, by hand, fashioned his tanning vats in much the same way the Indians made their dugout canoes. The trees also furnished the tanner with bark, which he cut and pulverized by hand by pounding it on rocks. The little business was carried on by his son of the same name. It was a modest but prosperous business consisting of tanning and dealing in hides, sole leather and findings, but it was even then hardly more than a household industry. Indeed, of all the household industries from which the early New England farmers augmented their income, perhaps tanning was the most lucrative and convenient. When the hides were made ready, they could be immersed in the vats and forgotten while crops were planted and cultivated,

JOHN HOWARD WHITTEMORE

Was born October 3, 1837 in Southbury the son of a Congregational clergyman, and died May 28, 1910. After studying for a while at Yale he took up the brokerage and banking business in New York City, soon after removing to Naugatuck and founding what is now the Naugatuck Malleable Iron Company of which he was president for twenty years and which was one of the earliest of its kind in the United States. He became interested in many other well-known Connecticut and western factories and also in the New York, New Haven and Hartford Railroad Company of which he was a director and aided largely in the improvement of the transportation facilities of the Naugatuck Valley. Quassapaug Lake and Middlebury owe many of their improvements, including the founding of the Westover school, to his love of nature and mankind. Hospitals and memorial libraries were endowed by him and also a professorship of education at Yale.

[illegible]

and when the harvests were complete and opportunity afforded, these hides were removed from the vats, finished and sold—mostly to neighbors for shoes and harness.

As the manufacturing era replaced the agricultural period, a new market for the tanned leather slowly developed. The early mills were driven by water wheels, which were connected to their countershafts by huge gearings, generally made of segments of iron bolted together and fitted with wooden teeth; and the power was transmitted from one shaft to another by similar gears. The shafts were of wood, usually maple, about four inches square, and turned to a round at the points at which they were supported by the wooden hangers. The pulleys were of wood, built upon the shaft and then turned. Shaft speeds and belt speeds were necessarily low. The several machines were usually driven by belts from the shaft to the machine, and for many years the belts were made by the operators of the mills from leather which they bought from country tanners. This leather was purchased in the form of "sides," which were cut into strips of the desired width and of the full length of the side, the pieces being laced together to secure the needed length. Later the end of one piece was lapped over the end of the other and riveted. Some of the mills stretched their belting by nailing the ends of the pieces to the floor when wet and driving wedges between the leather and the floor, halfway between the ends.

It is known that Asahel Jewell in Winchester had begun to supply leather for belting to some of the little factories in nearby towns. From the earliest times the Jewells kept painstaking and accurate accounts. The

first recorded instance in America of the commercial sale of a leather belt for industrial purposes was in 1826, by the second Asahel. Two years later, at Lowell, Massachusetts, was erected the first mill in the country to employ transmission from shaft to shaft by belts, and from that time the Jewell account books show a gradual increase in the length and width of belts and in the quantity sold. In 1845 the business, which had descended to Pliny Jewell, was moved to Hartford where a business of manufacturing leather belting was started. Very discouraging it must have been for the pioneer company! For some time the sales of the new product were few and small. The accounts show that Mrs. Jewell covered the deficit in the family fortunes by "taking boarders" in their home at the rate of $2.50 per person per week. But eventually the use of belting for machinery spread, wider belts were tried, and by 1850 the sale of a twenty-inch belt to a cotton manufacturer is recorded. There is no doubt that Pliny Jewell, who was the third person in the country in the belting business, taught many manufacturers to substitute leather belting for the cumbersome and expensive system of gearing for the conveyance of power.

Jewell's four sons were taken into the concern, which became P. Jewell & Sons. The tanyard was in what is now Bushnell Park, the present site of the State Capitol. Before the Civil War the firm was making belts thirty-six to forty inches wide, a fact received in England with incredulity. Bishop, writing in 1864, calls the company the largest of its sort in the world, and certainly it was the most famous. The Civil War and the subsequent growth of manufacturing during the latter part of the nineteenth century launched the company on a career of

Jewell Belting Company
Plant at West Hartford, Connecticut, erected 1920

prosperity which has continued. It has specialized in the manufacture of large belts for power transmission, but also produces round belting, automobile fan belts, chrome-tanned leather belting, lace leather, cut lacing and all kinds of leather straps. Recently a large new factory completely equipped has been built for the company near Elmwood in West Hartford.

The Norwich Belt Manufacturing Company of Norwich is another pioneer in the leather belting industry, having been established in 1845 by Charles N. Farman. It has specialized in dynamo and high speed belting, chrome-leather belting, laces and straps of various kinds. The founder conducted the business until his death in 1873, a period covering the difficult early years of the concern, which has since grown to large proportions. Its product is marketed throughout the United States and abroad.

The J. M. Delaney & Company of Meriden are manufacturers of sole leather.

Wire Products

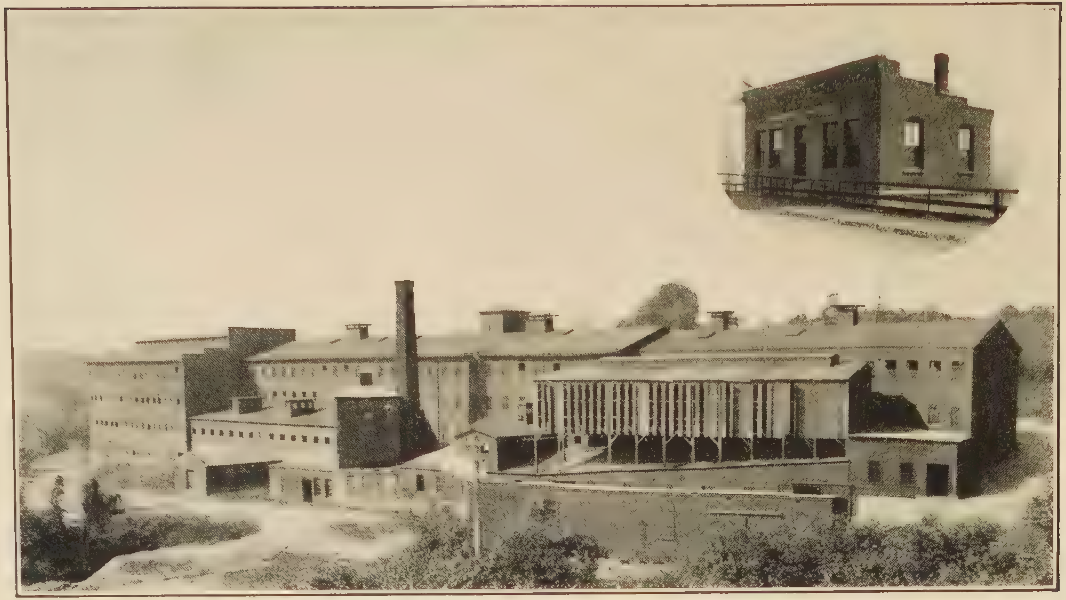
In the chapter on the brass industries the art of wire-drawing is touched upon, but the general manufacture of this commodity finds a more appropriate place here. The concern that possesses the greatest historical interest is the Gilbert & Bennett Manufacturing Company of Georgetown, which has recently rounded out a century of progress. This company typifies again the inspiringly simply story of the evolution of an almost pathetic household industry, growing despite the obstacles of poverty and ignorance of processes to a great corporation.

This wire works did not develop directly from the

near-by brass industry, but found its beginnings in 1818 in the weaving of hair, when Benjamin Gilbert abandoned his shoemaker's last, and in the basement of his home began the manufacture of the horse-hair sieves through which meal was sifted in the households of the day. His wife and daughters wove the hair while he shaved wooden hoops to form the rims of his sieves. Later, he added the manufacture of curled hair for mattresses and upholstery. Still later, he put in operation the first machinery ever used in picking hair and at last removed his little enterprise from his home to a part of an old saw-mill. At the time they moved from the home, 12 dozen sieves a day was considered a large output, and work was being "let out" to neighbors. His son-in-law, Sturges, being admitted to the partnership in 1828, the present firm name was adopted. William J. Gilbert, a son, was also admitted to the concern in 1832; in 1840, E. O. Hurlbutt, a son-in-law; and in 1844 another son, Edwin Gilbert.

Machinery was adopted and adapted for making the sieve rims, but the weaving of horse-hair by hand continued until 1834, when, in their search for a sieve material more durable than hair, they borrowed a neighbor's carpet loom and experimented with fine iron wire and produced the first samples of the familiar wire cloth which is now used in innumerable ways. To the new product they now added another, glue, which at that time was dried on a coarse sieve-like cloth and hence fitted into their plant. At the same time they experimented with the new wire netting instead of cotton netting, and thus revolutioned glue manufacturing.

The goods were sold as far west as the Western Reserve of Ohio, carried there on "Conestoga Wagons."



The Norwich Belt Mfg. Co., Inc., Norwich, Conn.
Manufacturers of Oak, Chrome and Unitan Belting

In 1852 a store was opened in New York. When the Civil War came on the company found itself shut off from its Southern market, with a large amount of woven wire on hand. What might have been a commercial catastrophe was turned into an asset by their application of wire netting to the making of window screens, which up to that time had been made of cloth or hair netting. Perceiving that they had, by chance and necessity, tapped a great market, they turned their chief attention to improving and marketing the new output, passing from the crude painted iron screen to the later methods of galvanizing, and finally to the modern rust-preventive treatments. A wire mill to produce their own wire was built, and power machinery was installed in the plants. For years this company was the only firm in the United States to make poultry netting, which, from a most unpopular product because of its alleged flimsiness, had grown to an enormous output and is now a familiar sight in the farmyards of the land. As steel and galvanized iron replaced the old crude iron, the glue and curled-hair interests were sold and the company concentated on its rapidly extending line of wire goods of various metals. In 1887 the firm established a western branch, located at first in Chicago and later at Wireton, Illinois, where there are now extensive buildings valued at $2,000,000.

Another large wire company is the present New Haven works of the American Steel and Wire Company, a subsidiary of the United States Steel Corporation. For half a century a wire works has been conducted on the site of the Pook and Bushnell shipyard. This concern is of particular interest because of its share in the financial backing of the historic "Monitor" of Civil War fame. It was situated on the east bank of the Quinni-

piac River and was called the New Hampshire Wire Company, Charles Atwater and other prominent New Hampshire business men being subscribers to its stock. The firm met considerable adversity, including a complete destruction of its plant by fire, and failed in 1887. The failure was largely due to the change in the industry from iron wire to steel. For several years the receivers and other interests continued the business with varying success, but always under the original name. In 1899 a new company was incorporated for $200,000, by John Wales and others, and the name changed—possibly for superstitious reasons, it is hinted—to the National Wire Company. The project flourished from the first, a rod mill being added to the plant. The company merged the next year with the National Wire Corporation with English connections, the Wales interests withdrawing. This was, in turn, incorporated with the National Steel and Wire Company along with various other plants throughout the country, the capital stock being $18,000,000. This holding company failed in 1906, and the plant was sold to the United States Steel Corporation the next year. The branch now has over 400 employees and has been converted into a specialty mill for the production of rope-wire, and wire ropes, sometimes called wire cables, and is the largest manufacturer in the world of this commodity. The ropes are used for elevators, dredges, suspension bridges, cranes, ships and the like; and also in lumbering, oil wells, drilling and mining.

Another concern doing a large business in electric wires and cables is the Atlantic Insulated Wire and Cable Company of Stamford, which was organized in 1902. It does an annual business of $2,000,000, and

has 215 employees. Its product is marketed chiefly in the United States, although it has a small South American business. During the World War it produced cable used in the field for the telephones and telegraphs employed by the Signal Corps.

Brown Stone

No history of Connecticut could be complete without mention of the Connecticut brown stone quarries, the hall-mark of architectural fashion during the Victorian era. On the east banks of the Connecticut River, at what is now Portland, nature had left great bluffs of brown sand stone. Because of the uniformity of color of this stone, it has been sought after by builders in all sections of the country.

When the town of Middletown was settled in 1651, it had within its borders the territory which is now the town of Portland. Quarry work was early commenced on these sand-stone bluffs, the stones being used for local building purposes. Shortly afterwards sloops from New York, Providence Plantations and Boston came up the Connecticut River with cargoes of supplies for the Colonists and returned with cargoes of stone. In 1665 the Middletown town records show the passage of the following vote: "September 4th, 1665. At a towne-meeting it was voted that whosoever shall dig or raise stones at ye rocks on the east side of the river for any without the town, the said digger shall be none but an inhabitant of Middletown, and shall be responsible to ye towne 12 pence per tunn for every tunn of stone that he or they shall dig for any person without the towne, this money to be paid in wheat and peas to ye townsmen or their assigns for ye use of ye towne within six months

after the transportation of said stones." At that early date a considerable quantity of the stone was shipped to distant places but we can find no evidence that a regular system of quarrying was carried on. Evidence exists, however, of efforts to supply the wants of a scattered and sparse population. In 1690 the town sold to James Stancliff six acres for quarrying purposes. Nearly a century later, in 1788, this property passed into the hands of Shaler and Hall, by whom the practical active work was commenced. In 1791 the same firm bought the ground of the lower quarry with a view to more extended operations in the future, which they commenced in 1844 by the organization of The Shaler & Hall Quarry company.

In 1819 another quarry was opened contiguous to the six acres bought by Shaler and Hall in 1788, under the name of Patten & Russell Quarry, to be known as the Russell & Hall Quarry until 1841, when it was united with the original Shaler & Hall upper property of six acres and the firms were incorporated under the name of The Middlesex Quarry Company. Hurlburt and Roberts also had purchased land between the Shaler & Hall Quarry Company property and the Middlesex Quarry Company property and began operations on this space in 1783. In 1814 Erastus and Silas Brainerd bought out Hurlburt & Roberts and carried on the business until Silas Brainerd died, when the firm of Brainerd & Company was formed. This partnership was incorporated in 1884 as a joint stock company under the name of the Brainerd Quarry Company. Thus all of the quarry lands and operations in Portland were concentrated under the ownership of three joint stock corporations. In March, 1896, The Brainerd, Shaler &

Hall Quarry Company was incorporated and it took over all of the assets of The Brainerd Quarry Company and The Shaler & Hall Quarry Company. In 1906 The Brainerd, Shaler & Hall Quarry Company bought all of the quarry and plant of the Middlesex Quarry Company. They also purchased the property of the Connecticut Freestone Quarry Company, of Cromwell, which they later sold to various individuals. The Brainerd Quarry Company, The Shaler & Hall Quarry Company, The Middlesex Quarry Company, and The Connecticut Freestone Quarry Company, have all been liquidated, and The Brainerd, Shaler & Hall Quarry Company now owns and operates the entire brown-stone quarrying industry of this vicinity and is the only producer of the famous Portland or Connecticut brown stone.

The volume of business done varies with the styles and methods of building construction. Shipments of stone are made to all parts of the United States and Canada. One of the most noted buildings in San Francisco, The Pacific Union Club, is built of Connecticut brown stone from the quarries of The Brainerd, Shaler & Hall Quarry Company, and shipments have been made as far west as Honolulu. The Quarry company owns and operates an industrial railroad which connects all parts of its plant with the "Air Line" Branch of The New York, New Haven and Hartford Railroad. It owns over a mile of water front on the Connecticut River and has ample docks and loading facilities for water shipments. The stone is used principally in the construction of fine residences, business buildings, university and college buildings, churches, school buildings, hospital building and other structures; also in the construction of

docks, retaining walls and bridges, and for dykes and breakwaters.

The quarrying season begins the last of March and ends the latter part of October. No stone is quarried in the winter. When first quarried the stone contains a certain amount of moisture known as "quarry sap," which evaporates on exposure to the air. When the blocks of stone are green and filled with "quarry sap" they are apt to burst in freezing weather. All stone is well seasoned before shipment.

The geological name of this well-known stone is Triassic brown stone. It is found in limited areas in several varieties in different states, but none yet discovered equals in quality to Portland deposits. The physical characteristics of the stone, distinguishing it from all others, is its uniform color, a rich, permanent brown, tinted slightly reddish, gray or bluish, according to variations in strata; its fine rift or reed; its easy working qualities, adapted to the finest carving; and its susceptibility to being rubbed or dressed down to a perfectly smooth, even surface. One of the noted characteristics of this deposit of brown stone is the fossiliferous tracks of varying size which abound at depths of from fifty to one hundred feet from the surface.

In the Quarry company's office at Portland there is to be seen an original copy of "The Middlesex Gazette or Federal Adviser," published October 13th, 1788, at Middletown, by Woodward and Green, Printers, on the third page of which appears an advertisement of The Shaler & Hall Quarry, who agree to contract for any quantity of stone and deliver it at any port in North America. On the opposite page is to be found an account of a decisive engagement on the 18th of June,

1788, between the Russian and Turkish fleets off the entrance of the Boristhenes, in which the Prince of Nassau commanded the Russian Fleet with Vice Admiral Paul Jones second in command. The Turks were defeated and their fleet captured or destroyed.

For many years the workmen in the quarries were native Yankees. Then followed the English, Scotch and Irish quarrymen. Many Cornishmen were at one time employed. In the quarry yards stands one of the largest Elm trees in the State. Under this tree the workmen used to get together during the noon hour and form a ring, whereupon it was decided, with bare fists and under the prevailing prize-ring rules, who was the champion of the quarry forces. About 1875 the quarry companies began to employ men from Sweden, and later on for many years the Swedes largely predominated. At the present time men are employed of various nationalities. Quite a few men are now employed who have worked steadily in the quarries for more than fifty years.

MACHINE TOOLS

WHAT chemistry is to the natural sciences, machine tools are to industry. Both are basic. A machine tool may be defined as the device which guides or impels minor tools in the cutting or shaping of metals. In more general terms, it has been described as the machine that makes the machine that turns out commercial products. In the chapter on "The Period of Transition" and elsewhere, we have recounted the revolutionary contribution to industry of Eli Whitney, upon which the modern factory system rests. Division of labor and interchangeable parts, indeed, are the foundation and framework of our marvellous industrial age.

Machine tools are the handmaiden of the factory system, and the work of machine tool builders has been complementary to that of Whitney and his followers. Valuable contributions to the literature of this branch of industry have been made in recent years, notable among which is the work of Joseph W. Roe, of New York University, on "English and American Tool Builders." In this brief chapter, therefore, there will be attempted only the barest outline of the history and place of machine tool building in manufacturing, and some of Connecticut's more noteworthy accomplishments in this specialty.

Since man has been characterized as a tool-using animal and his ascendancy credited largely to his ingenuity and skill in devising mechanisms to accomplish what he could not do with bare hands or nature's implements, it seems strange, that more definite advancement in the development of machinery had not been made prior to our present era. There were, of course,

infrequent essays at rational designing and a few fantastic suggestions, such as the sketches of Leonardo da Vinci; but the major advance was not definitely begun until the last quarter of the eighteenth century. Even in England, progress in the mechanics of machinery had been extremely slow until after 1760, although it is evident that serious consideration had there been given to the underlying problems of manufacturing and the importance of perfected machines. This is shown by the observations of Adam Smith in his "Wealth of Nations," (1776), and in a later study by Charles Babbage of certain mechanical improvements and refinements which were begun during this period and reached a considerable degree of attainment by the end of the first quarter of the last century.

The start of scientific machine tool building may be roughly dated from, and in certain important respects directly related to, the building of Watt's steam engine in 1789. Contemporary accounts show that the most perplexing problems in the production of this epoch-making invention were not those of the physical application of steam to the mechanism devised, but those of the designing and making of tools to produce the parts with sufficient accuracy to make the design a practical possibility and in commercial quantities to permit reasonable economy. Under this stimulus of necessity and in the pregnant atmosphere of the dawn of the industrial age, several master minds were working simultaneously, and in most instances unrelated to one another, upon this fundamental problem of mechanical accuracy and volume production. It is unfair to the genius of any mechanic to place too much stress on priority of design.

In the devising of tools for a definite purpose, it is reasonable to presume that, other things being equal, the mechanic whose job requires the more exacting accuracy will produce for the purpose a tool of greater refinement. The fact, for example that Maudsley in England and Silvanus Brown and David Wilkinson in America were simultaneously perfecting a slide rest for lathes during the years that date from 1791 to 1797 need not in any way detract from the credit due each of them for the development of this particular device. To Maudsley however, is due a recognition of the greater genius because of the more exacting and extensive uses to which his device was put, and on account of his other mechanical contributions and his development and application of new principles.

Professor Roe has expressed the view that, just as the manufacture of guns furnished a vehicle for the promotion and acceptance of the interchangeable principle in manufacture, so textile machinery has furnished a vehicle for the development of machine tools. Probably such may be the case, but a survey of the developments in the metal working field reveals operations in several lines calling for equivalent equipment. It is fair to presume therefore that other branches of industry have borne their part in stimulating machine tool building. Textile machinery was the objective at Lynn, Worcester, Providence and Pawtucket. The development of gun machinery was the objective at Windsor, Vermont; Springfield, Massachusetts; and Hartford, Middletown and New Haven.

Especially has this been true of Connecticut. Whitney's manufacture of guns in quantity called for and developed new types of machines that required main-

tained accuracy in their construction. There were other mechanical developments in the State indicating the early use of machine tools—such, for example, as Fitch's construction of a steamboat to ply the Connecticut River fourteen years before the "Clermont" steamed up the Hudson. This, of course, would have been impossible without mechanical exactness. In 1819 Seth Peck of Southington, patented a tin-making machine, which was employed in the picturesque industry that then flourished in and about Berlin, and has been described in the chapter on "Tools and Builders' Hardware." But the significance of these early achievements lies chiefly in the evidence they afford that machine tools existed at the time for the diversified operations required in their accomplishment, and that some of the principles now employed in the manufacture of parts were known and used at these early dates. Machine tools have always been devised as a means to an end, rather than as a *self sufficient invention per se*. It was the product of these tools, rather than the tools themselves, that received popular acceptance. Therefore, the early methods of machining used, were primarily mechanical necessities to accomplish the particular job at hand, rather than definite designs for adaptability and multiplicity of production.

The War of 1812 furnished added impetus to the designing of new machinery and the refining of those designs already established. The early principles answered the requirements of mechanical function, but during this period and that immediately following considerable refinement was accomplished in repetitive manufacturing equipment. The economic laws of division of labor and transfer of skill were, of course, more

evident than before, but in few instances were they recognized as the underlying principles. In fact, at the present time the most effective designs are accomplished by engineers who give little or no consideration to the purely academic sciences. As a relic of this period, there is in existence at the Sheffield Scientific School, at Yale University, a milling machine which was built by Eli Whitney about 1818, and it is very likely that from this machine developed the line of "Lincoln Millers" which became famous in later years.

The origin of many companies which later became prominent in the manufacture of machine tools occurred during the period between 1820 and 1840, among which may be noted the Hanks Foundry of 1821, later developed as Woodruff and Beach, who were builders of heavy machinery; and the Phoenix Iron Works, started by Levi Lincoln in 1834, which became, in turn, George S. Lincoln and Company, Charles L. Lincoln and Company, The Lincoln Company and finally The Taylor and Fenn Company of today. The history of this concern shows the development of the "Millers" which bore the firm name, and other tools required for the accurate processes used in the production of the Colt arms; and, with the increasing diversification of industry, it has broadened its output to more general lines of machine tools.

From the existence of several other manufacturers of metal products and a study of the products themselves, we may assume some extensive machine-tool building within the State during those years. It was during the decade of the Fifties, however, that this industry took on its real lease of life; for it is in this period that single and multiple drill presses, milling machines and lathes were

built by Lincoln, Robbins and Lawrence, Fetch and others for such exacting users as the Springfield and Colt armories, the Sharps Rifle plant and the New Britain and Naugatuck Valley industries.

The building of the Sharps Rifle Plant at Hartford in 1857 and the equipping of it with machinery from local plants and from the Robbins and Lawrence Company of Windsor, Vermont, is of special significance, for out of it grew the Pratt and Whitney Company which became definitely established as a source of machine tools just prior to the Civil War. As was customary, however, the Colt Armory and other users of machine tools designed and built many of their own. Elisha K. Root, who deserves high prominence among early Connecticut mechanics, was directly responsible for design and construction of the greater part of the Colt equipment.

In tracing the industrial lineage of men prominent in Connecticut's later industries, it is surprising to find how many derived their early training from this master, or from his shop in later years. Pratt and Whitney, Billings and Spencer, Fairfield of Hartford Machine Screw fame, Mason, Cushman, Bullard, Gleason were only a few. In a similar manner, the Pratt and Whitney works fostered the development of such men as A. F. Foote, G. C. Bardons, Johnston, La Point, Henn, Hakewessel, Worcester Warner and Ambrose Swasey; while employed by them at other times were Seymour, Gleason, Bullard and Gardner. Fitch brought out a semi-automatic turret lathe at Rockford, as early as 1845. Following 1855, the Hartford industries participated in a contract with the Vermont firm of Robbins and Lawrence to furnish the English Government with

machinery for the interchangeable manufacture of Enfield Rifles.

Many of the men Connecticut thus trained immediately spread to various parts of the country to carry on the manufacture of machine tools, but E. P. Bullard formed a partnership with Prest and Parsons in Hartford for the manufacture of several varieties of these machines. There are records of one of the earliest forms of self-aligning shaft hangers built by them, and in the Bullard plant at Bridgeport there is a drill press of Bullard design built in 1864. It was operated by W. W. Warner during his apprenticeship at Pratt and Whitney's and has in its design many features still considered good practice by machine-tool manufacturers.

At this period the scene shifts to Bridgeport. P. T. Barnum and others had bought the Sharps Rifle plant in 1875 and located it at the Bridgeport plant now better known as the Yost Typewriter Shop. Bullard also established a connection in Bridgeport in 1880 with A. D. Laws to manufacture lathes of Bullard design, and within a few months took over the business and established the Bridgeport Machine Tool Works, which he operated in connection with his sales office in New York City. In 1883 he built his first Vertical Boring and Turning Mill—a single head machine of 37″ capacity, belt driven. This was the fore-runner of progressive development of the boring mill principle, which has been modified and improved since that time into various types of single and multiple spindle machine tools, having extraordinary influence on the quality, quantity and economy in chucked work.

Among the other early Bridgeport establishments that

had a definite influence on the machine-tool industry may be mentioned Giles and Clancy, which later became Coulter and MacKenzie; Walter Brothers, manufacturers of planers and shapers; and the Pacific Iron Works, which comprised a foundry and a machine shop for the construction of engines and machine tools. J. L. Spencer built a speed lathe in Bridgeport and J. B. Secour manufactured screw machines. The A. H. Nilson Company was also among the early enterprises of that city which have had a definite and progressive influence on machine-tool design and construction.

Returning to Hartford for an account of concurrent developments, we find that the Billings and Spencer Drop Forge Plant had been established in 1866, an industry in which progress had been made possible through refinement of the board drop hammer by Spencer, and methods of forging by Billings. Spencer however, whose interests ranged from fire-arms and repeating rifles to automatic screw machine work, withdrew a short time after the establishment of the concern and formed with George Fairfield, the Hartford Machine Screw Company. Spencer had earlier developed an automatic turret lathe, controlled in operation by the application of cam strips to a blank cylinder, and it is this machine, improved and refined which is still being built by the New Britain Machine Company, of New Britain. Spencer's principle of cam cylinder control, sometimes called the "brain wheel," is considered of prime importance in machine-tool design; but, unfortunately, this feature was overlooked in obtaining patent rights and no appreciable benefits ever accrued to its inventor.

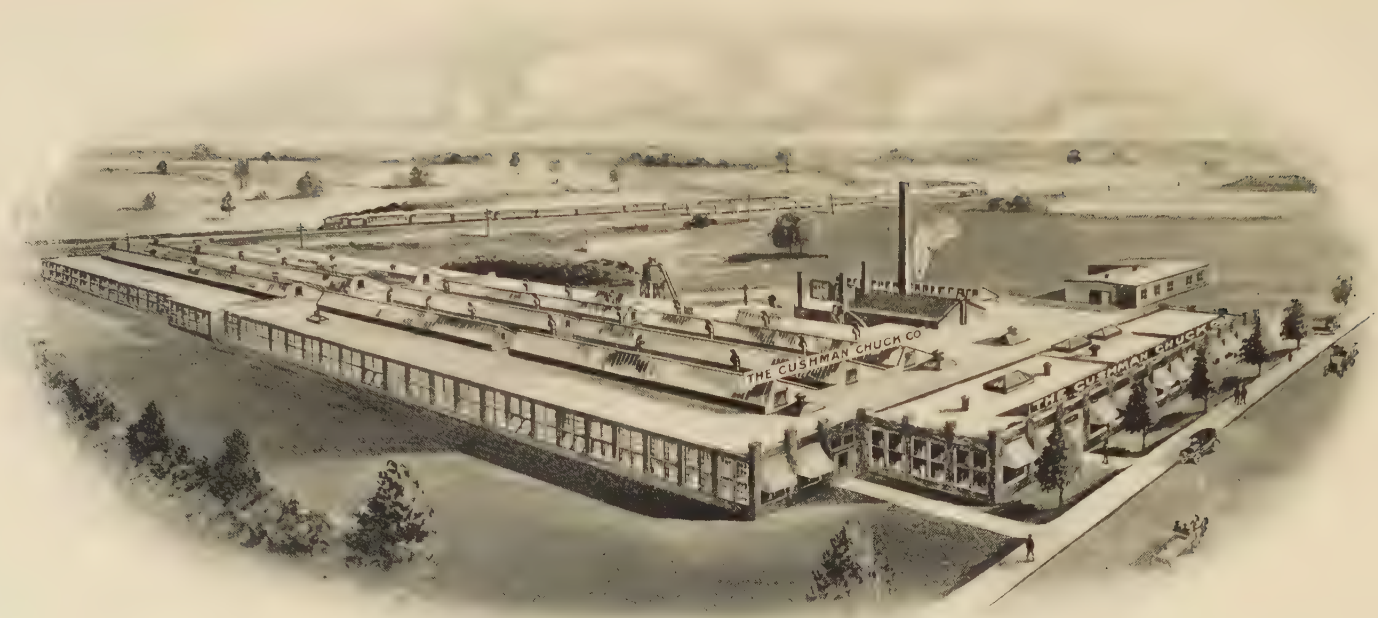
The buildings forming the Pratt & Whitney group

of the present day have had a various history, from the time of the Sharp's Rifle Works through the Weed Sewing Machine, Hartford Screw Machine, and the Pope Industries, until they were finally united under Pratt and Whitney management for the exclusive manufacture of machine tools. This company is now a part of the Niles, Bement, Pond Company.

A further interesting branch of the automatic screw machine development was that carried on by E. C. Henn of Hartford and Hakewessel, who, after preliminary development within the State, carried the business to Cincinnati to establish the Acme Screw Machine Company, which today occupies a position of prominence in the industry, with plants at Cincinnati, Cleveland and Windsor, Vermont. It is now known as the National Acme Company.

Chucks, accessory to machine tools, date back to the early days in Hartford when Cushman built them in a small shop which was occupied, for at least part of the time, by Christopher Spencer during his development of an automatic screw machine. It was also, just following this time, that Hartness appeared in Connecticut working at various places, including Pratt & Whitney's and Eaton, Cole and Burnham. He has stated that it was during his employ at a small shop in Winsted that he designed and worked out the principles of much of the automatic machinery which was later built by him at Springfield, Vermont.

Connecticut has achieved a prominent position in the manufacture of chucks. In 1830 Simon Fairman of West Stafford devised a holding attachment for a lathe in which the piece to be held was automatically centered while it was being gripped. President Andrew Jackson



Plant of the Cushman Chuck Co., Hartford, Conn.—1924

signed a patent for the device in 1830. Fairman was one of those inventors whose original ideas other men find ways to develop and put into practical use. Fairman's son-in-law—A. F. Cushman—made practical use of the elder man's idea and began to build chucks in 1862. The development of the modern lathe chuck owes much to Cushman and to Adrian P. Sloan, one of Cushman's associates. A chuck is often described as "the hand of a machine"—it being the attachment which holds the work. Sixty years ago all chucks were of the crudest form. Today no machine is built that is so powerful but that a chuck of proportionate strength is not being made for it. It is also worthy of note that the manufacture of lathe chucks of the finer types, from its beginning up to today, has been to a very large extent a strictly Connecticut industry. They were first exported in 1868, and the proportion that goes abroad is as great as ever. So highly are they esteemed for fine workmanship and extreme accuracy that certain chucks made in foreign countries are advertised as manufactured according to the "Cushman System."

Prominent chuck manufacturers in Connecticut are as follows: Skinner Chuck Company, of New Britain; Union Manufacturing Company, of New Britain; Cushman Chuck Company, of Hartford; D. E. Whiton Machine Company, of New London; Hoggson & Pettis Manufacturing Company, of New Haven; Jacobs Manufacturing Company, of Hartford.

A later Hartford development of the machine-tool industry is that of the Henry and Wright Manufacturing Company, organized in 1906, primarily to build a Sensative Drilling Machine, an invention of C. D. Rice

of the Underwood Typewriter Company. Shortly after the founding of the company D. M. Wright designed and patented a new style punch press which was added to the company's products.

There has also been some development of the machine-tool business in New Haven, the most conspicuous of which is the Eastern Machine Screw Corporation. This firm was organized in 1910 to take over the manufacture of an automatic screw machine, designed by Gates, which was being then manufactured by contract by the R. H. Brown Company of that city. In 1915 Gates invented a self-opening die head or threading tool. By this device, the production of the screw thread—heretofore the most difficult and laborious operation in the manufacture of screws—could be greatly accelerated.

Peck, Stowe & Wilcox of Southington and the New Britain Machine Company of New Britain also produce certain types of machine tools, but as their main output is in other lines their history is given under the heading of "Tools and Builders' Hardware."

There are doubtless several other concerns in the State producing isolated devices which might properly be placed in this class, but machine-tool building is an individual and specialized industry, calling for a particular type of plant and a highly developed organization of experts. Generally speaking, it cannot be carried on as a side line, and it is to such old and thoroughly organized concerns as Pratt & Whitney and Taylor and Fenn of Hartford and the Bullard Machine Tool Company of Bridgeport that manufacturers turn for the machines that make machines.

The machine-tool industry of the present day within this State, as elsewhere, is much more influential

Plant of Eastern Machine Screw Corporation at New Haven

Inserts show Mr. W. H. Gates, who originated the business, and his die head that revolutionized threadcutting

by virtue of its effect upon quality, quantity and economy in the production of other products than because of its variety and scope. Aside from chucks, gauges and small tools, which are not considered in the major class of machine tools, there are manufactured here the Hendey Lathe for tool room and production, several makes of high grade grinders, millers, and drills, boring mills and multiple production machines made by such concerns as The New Britain Machine Company, Goss & DeLeeuw and The Bullard Machine Tool Company. Scattered throughout the State are many smaller concerns which specialize in the manufacture of light tools for a single purpose or for a restricted class of work. The quality of these tools proves that the State is still the home of high grade skilled craftsmen who religiously adhere to the New England characteristics of thoroughness, dependability and thrift.

POWER—ITS PRODUCTION, TRANSMISSION AND USE

TO BE successful, the manufacturer must find labor, capital and markets. This is a truism whose statement may even seem superfluous. There is, however, another essential factor in industry, whose recognition by the general public is by no means so universal. That is power. In Connecticut, with its low ratio of water power to plants to be served and its remoteness to the coal fields, this is a problem whose acuteness increases with each passing year. In this chapter an attempt will be made to sketch the sources and uses of industrial power from Colonial days to the present time, and to outline the systems now in use or in the process of development.

The first power to be employed when the settlers located in the Connecticut Valley and along the Sound was that conveyed by human agency, the most familiar example of which being, of course, the treadle of the housewife in operating her loom. Along with this came animal power, which was used to a considerable extent to supplement the growing household industries. Indeed we have seen that as late as 1832, Charles Parker, founder of the Meriden concern that bears his name, and which has since become the producer of the famous "Parker" gun and of a diversified line of metal products, used as his first power "a blind horse who propelled a pole sweep." The first employment of power, however, in the modern and generally understood sense of the term was by the old overshot waterwheels, a picturesque survival of which may be seen in the outskirts of New London as one motors northward toward Nor-

wich. Says Mr. A. C. Hickmott of Hartford in an interesting and philosophic survey of Connecticut's power, past and present: "The building of homes became gradually a trade that required something more than a sporadic working in timber, and it proved easy to install a water-wheel at a point of vantage for the sawing of lumber. From this it was but a step to the utilization of this energy for the grinding of grain. Some of the oldest grist mills were: One installed at Little River (Hartford's present location) about 1637, one installed at Milford in 1640, and one at Derby in 1681. These little mills were equipped with the overshot type of water-wheel—truly not an economical method of producing power, but one which sufficed for the then small needs. In this connection, it is interesting in passing to note the following description of Milford, taken from Washington's diary under date of October 17, 1789: 'In this place there is but one church, or in other words but one steeple, but there are grist and saw mills, and a handsome cascade over the Tumbling Dams.' Even then the State was headed on the way it was to go."

But as industries began to emerge from the cellars, kitchens and barns and find a habitation in primitive "factories," water power came to be employed for their operation. Some authorities are, indeed, inclined to ascribe Connecticut's subsequent industrial career to the start given the manufacturer by these streams. A study of the history of the several industries of the State, as revealed in the accompanying chapters of the volume, fails to bear this out. Other factors, notably the contiguity of the Salisbury and Granby mines, the rare inventive genius and business ability of the people,

and surprising and original developments in the arts of salesmanship and distribution were what chiefly determined the bent of Connecticut business. But convenient water power had its place and bore its part. For instance, we have seen how Eli Terry, father of American clock making, left his home on the hills and sought a site on the Naugatuck River in order to harness its slender power to do his work; and how a little undershot water-wheel, located at the bottom of the tailrace of an old distillery, with only a six-foot drop, furnished the initial power for what has since grown into the great Cheney Silk Mills at South Manchester. Mr. Samuel Ferguson of Hartford, a recognized authority on power, thus sums up the past and present relationship between factories and mill-sites in a noteworthy paper on "Connecticut's Power Problem as Affecting Its Industrial Life:" "An automobile trip through New England will show how early New England factories were located on all available streams. There are now three classes of such factories—prosperous, struggling and abandoned. The prosperous ones have rail connections, and have supplemented the water with steam, which is either now in use, or in turn has been supplanted by electricity. The struggling ones also have steam plants, but labor under the disadvantage of carting fuel. The abandoned plants are evidence of the impossibility of competing when handicapped by an unreliable source of power."

An example of the accuracy of Mr. Ferguson's diagnosis is furnished by Windsor Locks, which is a prosperous manufacturing river-town. It was at the fall in the Connecticut River at Enfield, just above the locks, that there was built the first of the great water-power

plants in the history of the State, and for many years the largest. And it is interesting to note that its original purpose was for the improvement of navigation, although the charter which the Connecticut River Company, its builder, secured from the General Assembly in 1824 also gave it the right to acquire mill sites in the vicinity. The art of drafting charters evidently was not unfamiliar to our ancestors. The project was completed in 1829, and began to be used for industrial purposes in the Thirties. It develops between 3000 and 4000 horse power, and has been used by contiguous factories ever since. From the early Sixties to 1913 it was held and administered by the Dexter and Coffin families of Windsor Locks, upon the latter of which dates it was sold to the Northern Connecticut Securities Company. Difficulties in securing satisfactory rights from the Federal Government and existing high costs of construction have delayed the building of the 20,000 horse power hydro-electric plant that its present owners have in view.

Another example of the retention of industries by a given locality is Rockville. Its factories originated along an available water power in a series of steps. Through rail transportation, and the addition of steam and electricity as sources of power, the factories have continued to grow, long after the water power which gave them a start became a negligible factor. The city is now one of the State's important, though smaller, industrial centers.

The first type of water-wheels were the over-shot and under-shot, which served their purpose in their time, but during the period between 1860 and 1870 the turbine water-wheel came into vogue. This brought to water power a similar increase in efficiency to that produced

by the introduction of the turbine to the steam engine at a later date. The subsequent story of water power in Connecticut is incidental to the story of steam, and later to that of electricity. The old factory or mill, operated by direct water power, has become practically obsolete. Water power now plays its chief part as the producer of electricity; or, acting as the consort of steam, becomes one of the parents of electricity.

Let us now turn to the story of steam. We are unable to state, even if it is known, when the first steam engine was installed for industrial purposes in Connecticut. In our accounts of particular industries, we have frequently found it recorded, as an event of note, that at such-and-such a time a steam engine was purchased and placed in use. Some authorities ascribe New Haven's long supremacy in the manufacture of carriages to the fact that George F. Newhall, at an early date, introduced steam power into the industry, after having noted its use in Rhode Island—although doing it against the pessimistic predictions of his neighbors and competitors. The early engines were small and relatively crude and inefficient. During the first three-quarters of the nineteenth century they filtered into the State as circumstances required, their historical significance being expressed in their influence on the arrangement of plants, and the location of towns. At first they were used as auxiliaries to water power; as, later on, electricity was first employed as an auxiliary to steam. With the increase in the size of the plants beyond all possibility of operation by water, the manufacturer came to rely almost entirely on steam. This wrought an immediate change in the geography of the State. Coal had to be secured to feed the boilers, and transportation came to

be a determining factor in the location and growth of cities. Emancipated from their servitude to water power, manufacturers flocked to Bridgeport, New Britain and other distinctly industrial centers. Where the plants still remained by the sides of the streams, the inauguration of steam permitted a re-arrangement of buildings and a spreading out of the villages. Mr. Hickmott thus describes the gradual entrance of steam upon the stage: "As water power became insufficient to meet the needs of the companies, steam engines were brought in to supplement the variation in flow. With this ability to continue a uniform method of production, the plants expanded and as this expansion went along, additional plants need not be on the water itself. This marked the gradual taking over of most of the burden by the steam units, until steam, commencing as a mere helper, became the main power source. The original reason for locating upon a stream which furnished water power was largely gone; but the plants continued, as steam units, for it is difficult to bring about a change in location of a factory which represents large investment capital. Connecticut thus was still in the position of a leader in the industrial field."

One concern, now nearly half a century old, has this brief history of the use of steam: Installed in 1881 an old "Buckeye" engine of about 50 horse power, of the reciprocating type; a few years later a "Woodruff & Beach" reciprocating engine was added to the plant, the horse power not appearing. In 1895 these were succeeded by a 600 horse power "Corliss" engine; while, nine years later, in 1904, the power plant was augmented by a 900 horse power "Brown Corliss"

engine. Here electricity begins to claim the field and the history of steam in this particular plant comes to an abrupt end. This condensed story probably presents a fairly typical picture of the use of steam during later periods of Connecticut industry. The plant in question was not located near a stream, and never has used water power.

We now come to the latest, the most revolutionary, and the most dramatic chapter in the development of power. Much has been written and sung of the "romance of steam," but we are now standing in the presence of an even greater romance of electricity, and its possibilities lie in the shadowy land of dreams and the imagination. Here again, its entry upon the stage may be best portrayed by a concrete illustration, taken more or less at random, but presumably fairly typical of progressive modern industries. This is the Hartford Rubber Works, a relatively large consumer of power because of its heavy operations.

This company's first use of electricity was for lighting purposes. Previous to 1892, the plant had received its artificial light from kerosene lamps—one woman devoting her entire time to keeping them filled and cleaned and the wicks properly trimmed. At this date, a 200 light generator was attached to an old reciprocating steam engine. Owing to the then unreliable character of electric lighting, a reserve gas jet was installed along with each electric light. The wisdom of this precaution was shown when, about a year later, the old engine "ran away" one day, whirling the shaft so rapidly that the little 200 light generator "blew up." There was next installed, in 1894, a 600 light "Mather" generator, made by the Mather Motor Company of Manchester, Connec-

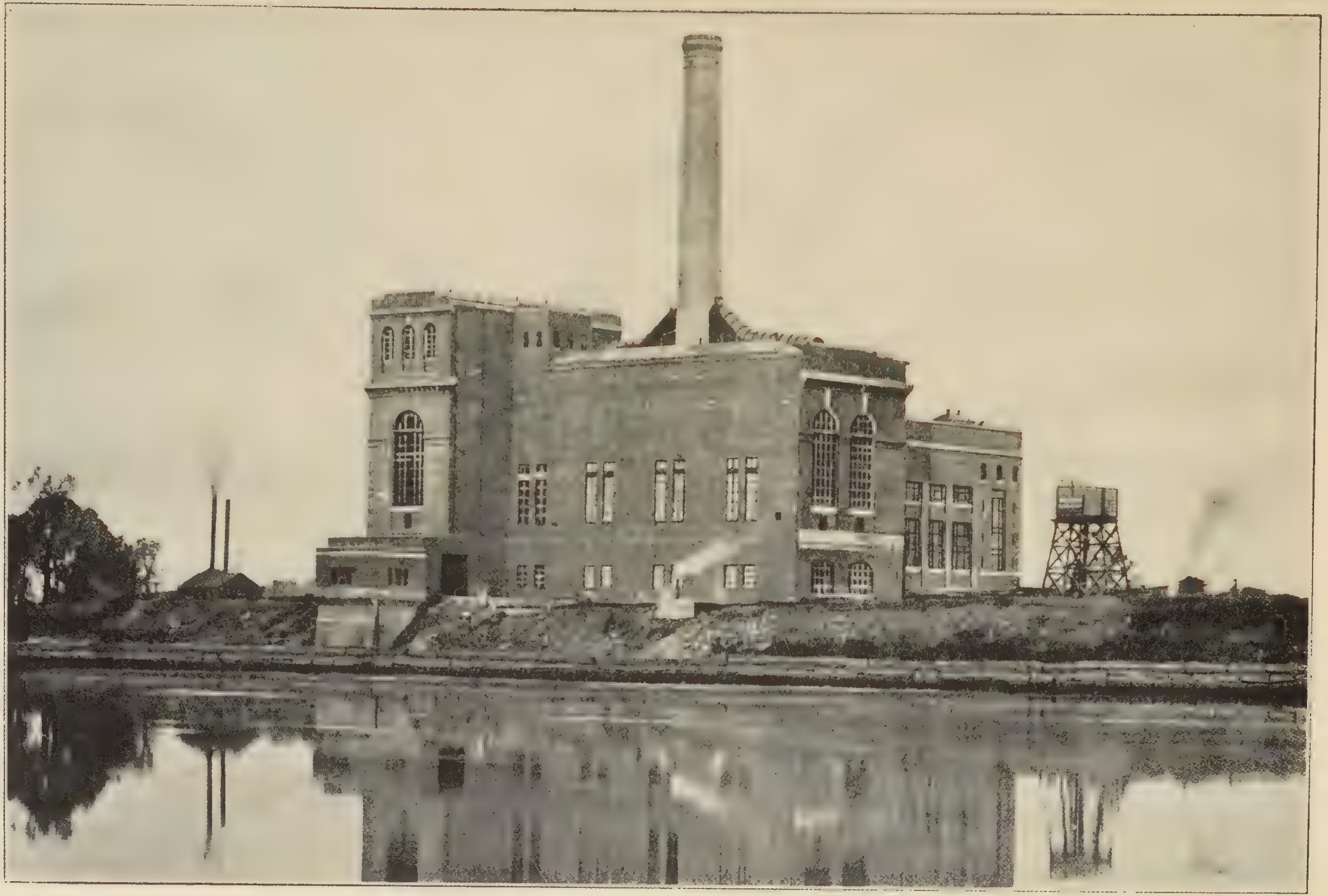
ticut. This old generator did its work and, in the words of the present management, "has been changed into a motor and is still doing duty in our factory, as good as the day it was purchased, which speaks well for the construction of equipment in those days." As the plant outgrew this generator, another was added, built by the Eddy Manufacturing Company of Windsor Locks. This brief episode of the adoption of electric lighting, the power being furnished from the plant's own equipment, is thrown in as an example of how a typical modern industry first drifted into the use of electricity in any form.

It was ten years later, in 1893, that this concern first used electricity for power. It came about in a natural way. Across the street was a machine shop, inconveniently located for the application of steam power by shafting and belts. Here an electric motor was established for power purposes, being fed, of course, from the company's own generators. The success of this departure was so immediate and apparent, that thereafter a similar form of drive was adopted in the case of all isolated machines in the plant. Nearly ten years after that came another characteristic development—the beginning in 1912 of the purchase of power from the local public utility, at which time it became necessary to install a motor-generator to convert the commercial alternating current into the direct current used by the company's motors.

In 1919 came the final step, which brings the picture down to date. That was the complete electrification of the plant, with the erection of a separate sub-station to transform and distribute the current, received in wholesale quantities over a high-

tension line from the Hartford Electric Light Company. Here an operator, with an elaborate system of buttons and switches, controls the power that is sent out to nearly one hundred rooms or departments, the requirements and consumption being registered by a long double row of dials. The machines of the plant are served with power individually or in groups, as circumstances require, and the fluid is sent out to them with the precision—and, it would almost seem, with the intelligence—of the nerves radiating from the brain to the parts of the human body. In the earlier days of the plant the installation of a 500 horse power steam engine was an event; now there are several 750 horse power motors driving groups of machines, and in one room nearly 100 individual motors of low horse power driving individual machines and controlled by treadles with the same sub-conscious ease with which the trained motorist operates the clutch and the throttle of his car. This example, in a more or less sketchy and impressionistic way, completes the picture of the entry of the giant, Electricity, upon the stage of a modern industry.

At this point, a brief account should be given of the methods of transmitting power within the limits of the plant itself. In the early days, as appears in another chapter in connection with the history of the Jewell Belting Company, power was conveyed from the water-wheel by a system of gears with wooden cogs, attached to shafts, and finally applied to the operator's machine by a home-made belt. In the old factories—even those of a much later period, when wooden gears had been superceded by metal, and highly-perfected leather belts were commercially marketed—the lay visitor was bewildered by the network of shafting, pulleys and belts. In the



The South Meadow Station of the Hartford Electric Light Company

modern fully-electrified plants, the machine of the operator is connected with the power station of the plant by two concealed and protected wires. There is, however, some doubt as to the practicable limits of the individual electrification of machines. Considerable controversy exists on this point, the conclusions of the best engineers being that it is a matter of expediency. Under certain circumstances the individual drive is preferable; under others the "group drive"—by which is meant a series of machines driven by one motor, but with belt-connection from a common shaft—is more advantageous.

To view the power situation in Connecticut from the standpoint of a single plant, or that of a single public utility wholesaling power to that plant, is to get so near the forest that one cannot see the trees. Here again the comprehensive review of Mr. Hickmott may well be drawn upon: "In the early Nineties occurred another revolutionary change. The Billings and Spencer Company of Hartford contracted with the Hartford Electric Light Company for a supply of power to be generated by the Light Company and furnished to them at wholesale rates. This was an innovation in more ways than one. It meant that no longer need the factory even maintain its own separate power plant, built and maintained at enormous cost. It also inaugurated the era of selling power, under contract, at a rate far below that hitherto charged for electric lighting purposes. It took courage for the Electric Light Company to embark upon this departure, and it was strongly criticized, not only from the angle of possible diminishing returns to its stockholders, but also from viewpoint of its competitors,

who might now in turn be forced to the sale of power at an equally low rate. The judgment of the innovators was vindicated. All credit is due to this public utility, years ahead of its time, for taking such a radical step.

"Early in the present century, there came still another innovation. It proved no longer feasible to attempt the expansion of steam-driven generators, due to the large connected load developing. The steam turbine then came to replace the steam engine, bringing with it greater economy, greater efficiency and a possible expansion without recourse to extensive construction. It has been possible to go on increasing the size of these turbines, a process which has gone on from the small vertical turbine of perhaps 750 kilowatt capacity, to the great horizontal turbines of today running their capacity up above the 50,000 kilowatt mark. Here again it was the Hartford Electric Light Company which took the lead, installing the first steam turbine in commercial use, not only in Connecticut, but in the country.

"And what of today? Connecticut is now divided into four main power districts. In the east is the Eastern Connecticut Power Company, with a great steam station of an installed capacity of about 45,000 horse power located on the Thames River at Montville. This plant serves as a central distributing point for the supply of light and power to the greater part of the eastern section of Connecticut. In the west and southwest is the Connecticut Light and Power Company, with hydroelectric development of 24,000 horse power at Stevenson, a 90,000 horse power steam station at Devon, and a total generating capacity of over 155,000 horse power. This company serves the southwestern and western sections of the State, and wholesales considerable power.

New Haven and Bridgeport are served by the United Illuminating Company, an old-established concern which has been the outgrowth of small local plants. The northwestern, north central and central sections of the State are served by the Hartford Electric Light Company, and its subsidiary, the Connecticut Power Company. The main plants of the Hartford Electric Light Company consists of two steam stations located on the Connecticut River south of Hartford. The Connecticut Power Company has a model hydro-electric development at Falls Village on the Housatonic River.

"What a change from the few water-wheels of a century ago! And there has been a corresponding change of function for the rivers. More and more they are becoming important for their supply of condensing water for steam stations and for their ability to deliver cheap coal to such plants, rather than as a means, in their own flow, of generating power directly. Water power is cheap, and when it can be advantageously used, it is a great boon; but it is the great steam generating stations of the State that are carrying, night and day, that constant load which means an ever-ready supply of power available for Connecticut manufacturers."

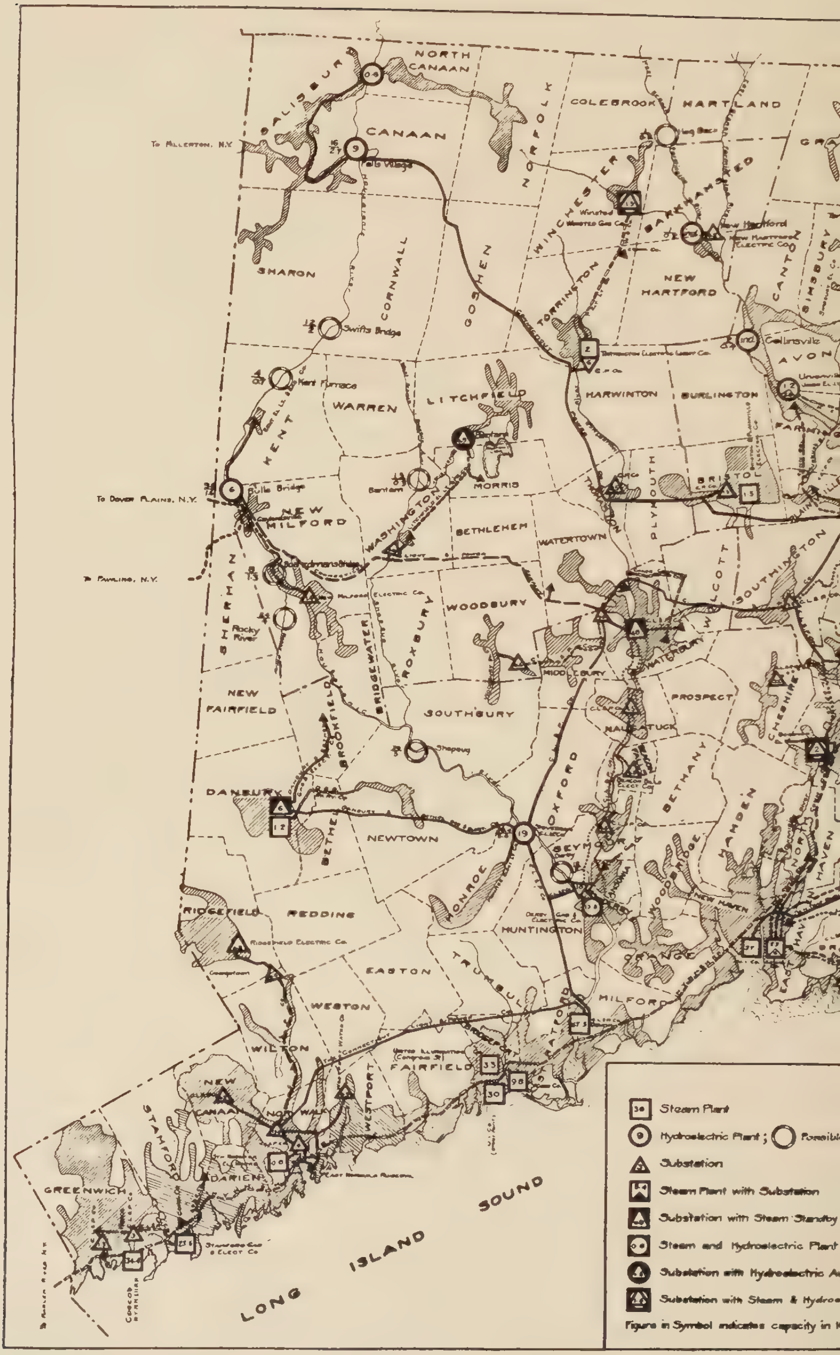
Mr. Hickmott's reference to the far-reaching results flowing from the invention of the steam turbine should remind us of the presence in Hartford of the largest exclusive manufactory of steam turbines and reduction gears in the United States. This is the Terry Steam Turbine Company. A brief account of this concern probably belongs more properly at this point than at any other.

As might be expected from the comparative recency of the invention, this firm is not an old one. It started

its corporate existence in 1906 under the leadership of E. C. Terry, who, previous to that time, had done a large amount of research and experimental work in this line. Nearly ten years prior to his organization of this company he did his first work on steam turbines. The number of machines produced during the early years was of course few, but those placed on the market demonstrated their mechanical efficiency and commercial value.

During this early period, Terry's factory was located on State Street in Hartford. As it became apparent that a product was being developed for which there would be a large demand, a modern factory building was erected on Windsor Avenue, where the present plant is now located. Additions have, of course, been made from time to time.

While the output of this concern has been used in nearly every variety of industry, its main use in the past has been in central power stations and by the United States Navy. Indeed, this department of the Federal Government was one of the first to recognize the merits of the Terry design. It is pointed to as a rather odd coincidence that the first naval vessel to be equipped with this product was named the U. S. S. "Terry." This was of the destroyer type and marked a considerable departure from past practices, in that the forced-draft fans were driven by vertical steam turbines. From that time every destroyer in the United States Navy has been equipped with turbine driven blowers. The airplane carrier "Saratoga" which was launched at Camden, New Jersey, just as this volume is being completed, and which represents the latest development in naval vessels, is also equipped with Terry turbines. Indeed, this huge ship has a total of 8,300 horse power in Terry machines.


NORTH CANAAN
SALISBURY
CANAAN
NORFOLK
COLEBROOK
HARTLAND
To Millerton, N.Y.
SHARON
CORNWALL
GOSHEN
WINCHESTER
BARKHAMSTED
NEW HARTFORD
TORRINGTON
Swifts Bridge
Kent Furnace
WARREN
KENT
LITCHFIELD
HARWINTON
BURLINGTON
AVON
Collinsville
Bulls Bridge
To Dover Plains, N.Y.
NEW MILFORD
MORRIS
Bantam
WASHINGTON
BETHLEHEM
WATERTOWN
PLYMOUTH
BRISTOL
To Pawling, N.Y.
SHERMAN
Rocky River
WOODBURY
ROXBURY
BRIDGEWATER
WOLCOTT
SOUTHINGTON
MIDDLEBURY
WATERBURY
NEW FAIRFIELD
SOUTHBURY
PROSPECT
NAUGATUCK
BROOKFIELD
Shepaug
CHESHIRE
DANBURY
NEWTOWN
OXFORD
BETHANY
HAMDEN
BETHEL
MONROE
SEYMOUR
RIDGEFIELD
REDDING
Ridgefield Electric Co.
HUNTINGTON
WOODBRIDGE
ORANGE
EASTON
TRUMBULL
WESTON
MILFORD
WILTON
FAIRFIELD
WESTPORT
NEW CANAAN
STAMFORD
NORWALK
DARIEN
GREENWICH
LONG ISLAND SOUND
Steam Plant
Hydroelectric Plant ;
Substation
Steam Plant with Substation
Substation with Steam Standby
Steam and Hydroelectric Plant
Figure in Symbol indicates capacity in


STATE
OF
CONNECTICUT
Map showing Route of
High Tension Transmission Lines
and
Areas served by the
Several Electric Utilities
Prepared by the
PUBLIC UTILITIES COMMISSION
Revised to Jan. 1, 1928
66,000 Volt Transmission Line
33,000 " " "
26,000-22000 V. " "
13000 Volt " "
11.000 " " "
Low Voltage Tie
Street Railway & other Substations
Area of Electric Service
Circle means Industrial Development
SOMERS
STAFFORD
UNION
THOMPSON
WOODSTOCK
ENFIELD
Thompsonville
Windsor Locks
ELLINGTON
EAST WINDSOR
SOUTH WINDSOR
TOLLAND
WILLINGTON
ASHFORD
EASTFORD
POMFRET
PUTNAM
KILLINGLY
Danielson
VERNON
Rockville
MANCHESTER
EAST HARTFORD
BOLTON
COVENTRY
MANSFIELD
Eagleville
CHAPLIN
HAMPTON
BROOKLYN
ANDOVER
COLUMBIA
WINDHAM
So. Windham
SCOTLAND
CANTERBURY
PLAINFIELD
STERLING
GLASTONBURY
HEBRON
MARLBORO
LEBANON
FRANKLIN
LISBON
Jewett City
GRISWOLD
VOLUNTOWN
PORTLAND
EAST HAMPTON
COLCHESTER
BOZRAH
NORWICH
PRESTON
Leesville
EAST HADDAM
HADDAM
SALEM
MONTVILLE
Thamesville
NORTH STONINGTON
LEDYARD
Hadlyme
KILLINGWORTH
MADISON
CHESTER
LYME
EAST LYME
WATERFORD
GROTON
STONINGTON
SAYBROOK
ESSEX
CLINTON
WESTBROOK
OLD SAYBROOK
OLD LYME
New London

The company has also, of course, built a large number of machines for industrial plants, in which cases they are used for driving generators, line shafting and similar equipment. They are built in all sizes up to 1,500 horse power or 100 kilowatts and are particularly adapted for motive power in paper mills, textile mills, oil refineries, sugar companies, laundries and chemical concerns.

As evidence of the sturdiness and long life of the Terry product, some of the first machines constructed under the supervision of the inventor and founder are still in operation after twenty years of service. It is peculiarly fitting that alongside of the Hartford Electric Light Company, which has been a pioneer in many departments of the production, sale and distribution of power, there should have grown up the largest factory in the country producing a device of fundamental necessity in the conduct of its activities.

Striking as have been the developments in the electrical field, there are even wider and more pregnant aspects of the problem. The accompanying map shows how the power lines of Connecticut are tied up. The amazing extent to which what is often referred to as the "superpower" problem, agitated by the Federal Congress, is being worked out by private initiative belongs in this history; for upon its successful culmination may depend to a large degree the industrial future of the commonwealth. The underlying philosophy of tying together a series of plants is thus set forth by Mr. Ferguson in a recent address, in which he is stenographically reported as saying: "In the days when each city had its own power plant, the size of the unit was naturally limited by its ability to develop load. It was impossible to gain ef-

ficiency, say, by going to a 20,000 kilowatt unit in a town or city where the maximum load was only 8,000 or 10,000. You might gain in efficiency, but you lost so much more in your fixed charges that it was not practicable. That difficulty has been solved, to a certain extent, by developing the plant in a logical location to serve more than one city. Take, for instance, our station here. We have in Hartford a plant very much larger than the needs of the city would warrant us in building; but, if we did not have such a plant, Hartford could not benefit by the economies of size. But by running transmission lines out from Hartford to the neighboring towns and cities, and combining their requirements with those of Hartford, it makes the total combined load enough to warrant large and efficient units being installed in one place.

"Comparing Hartford and Middletown—Middletown had a possible load of maybe 2,000 horse power; Hartford a possible load of 30,000 horse power. There was no conceivable way that Middletown could operate a plant of its own and get the economies that we get with large units. The economies of a large-size plant in Middletown have been obtained—at some expense, it is true—but they have been obtained by means of a high tension transmission line connecting Middletown and Hartford together, so that the power that is made for Middletown is made in turbines of large size and high efficiency, located in the Hartford plant. That is only possible, if the fixed charges on the interconnecting high tension line are less than the savings to be effected. It is being demonstrated everywhere now, that cities and towns can be connected up at a lower cost than the difference in efficiencies." Mr. Ferguson goes on to point

out that by establishing these power centers and interconnecting them, three great advantages result: First, an increased reliability of supply; second, a saving in investment; and third, economy of operation.

There is also being carried on by the Hartford Electric Light Company an experiment—or, rather, a demonstration—which is the first of its kind in the country. That is an increase in the number of electric units produced from a pound of coal, by the use of mercury rather than water in the engines. Concerning this Mr. Ferguson says: "It looks as if we could thus make a saving of 40 per cent in fuel, as soon as the designers can get rid of the mechanical difficulties that are inherent in any new undertaking. We feel that it has now reached the stage where it is purely a question of improvement and perfection of the commercial design."

The extent to which the super-power dream in its relation to Connecticut has already become an accomplished reality is shown by the fact that the Hartford system is linked up with other systems in the following manner: The Hartford Electric Light Company is connected with the Turner Falls System, which includes the city of Springfield; the Turner Falls plant is connected with the line of the New England Power Company system; the New England Power Company is linked up to the Adirondack Power Company; the Adirondack Power Company is linked up to the Syracuse Light Company, and this company is linked to the Niagara Falls Power Plant. Hartford is connected on the east with the Boston Edison Company through Turner Falls. Commenting upon this situation, Mr. C. L. Campbell of Waterbury is quoted in "The Hartford Times" of February 28, 1925, as saying: "If all stations between

Waterbury and Niagara should cease consuming or producing power, we could say positively that Waterbury was receiving from Niagara Falls. Under the circumstances, however, with all the stations using and generating, it is impossible to pick out a 'drop,' so to speak, of electricity and label it as coming from Niagara. There are times when there is no actual connection between stations, according to local demands, but it is always available."

Experiments have been made from time to time to test the efficiency of this system. For instance, recently the plant at Turner Falls, Massachusetts, was "dead." An official, known as the Load Despatcher, sent out an "S.O.S." call to the next station, which was in turn relayed to the next. The call was passed along until all stations had turned in enough current from their surplus load to the main connecting line so that the Turner Falls plant was supplied with current for its needs, without knowing at the time just where it came from. Recently a similar experiment was made in Hartford. For the first time in thirty-three years the plant of the Hartford Electric Light Company was idle. The efficiency of the recent connection made with the Turner Falls plant through the station at Agawam, Massachusetts, was demonstrated by this experiment.

The principle sources of power domiciled in Connecticut are the water and steam plants of the four larger companies, supplemented by plants of the various smaller companies. The four larger plants are:

(1) Connecticut Light and Power Company. (70,000 kilowatts steam; 20,000 kilowatts water).

(2) Hartford Electric Light Company. (75,000 kilowatts steam; 10,000 kilowatts water).

(3) United Illuminating Company (New Haven-Bridgeport). (50,000 kilowatts steam).

(4) Eastern Connecticut Power Company. (30,000 kilowatts steam; 10,000 kilowatts water).

In addition to the sources already described, there is always in the offing the not remote prospect of connection with the great St. Lawrence River and other Canadian power sites, as yet undeveloped. As this volume goes to press, the Connecticut General Assembly is considering an application for charter rights that will make this incalculable supply available to its citizens, whenever the stage is reached that the construction of the dams and power houses and the long transmission lines is shown to be economically necessary and commercially profitable.

THE OYSTER INDUSTRY OF CONNECTICUT

By Henry C. Rowe

Introduction

FROM 1875 to 1890 Connecticut led the world in the development of the oyster industry. By "the oyster industry" is meant the propagation, and culture of oysters by human enterprise, as distinguished from the natural production of oysters which has existed in certain limited areas from prehistoric ages.

A familiar definition of modern oyster culture in Connecticut is found in the simple words "oyster farming." Oyster farming, on a large scale was commenced in Connecticut in 1874 and was extended and developed during the next six years to vast proportions, beyond comparison in extent with any which had previously been accomplished, or even undertaken, in any part of the world at any time in history.

By 1880 a great industry was established, capable of producing food to a value of millions of dollars annually, and although steam was employed for the heavier operations, such as dredging, thousands of persons found occupation in its production.

While the natural product had formerly been found in the estuaries and bays, the artificial propagation of oysters was pursued in the open waters of Long Island Sound extending many miles from land and to a depth of more than sixty feet of water. An area of more than 80,000 acres, which had not formerly been productive of oysters, was utilized for this enterprise.

Connecticut oyster farmers created an industry with methods quite different from those of oyster cultures

which have, for centuries, existed in France, Italy, Great Britain, Japan, and other foreign waters. The operations of Connecticut oyster growers far excelled in efficiency, economy, magnitude, and success, those of any of the countries above mentioned, either in ancient or modern times.

Between 1880 and 1890 men came from nearly every coast state in the country to ascertain the methods of Connecticut oyster growing, with a view, as far as possible, of copying these methods.

As early as 1878 and 1880, some growers including the writer, shipped Connecticut oysters in large quantity to the Pacific Coast States, to Great Britain, and to Germany. Representatives of far-off Japan (in pursuance of the policy of that wonderful people to acquire and utilize information) sought to learn of Connecticut oyster culture, with a view to the development of the industry in Japanese waters. After their return, the government of this polite people sent to the writer, beautiful and artistic gifts in token of appreciation of this information.

Mankind compete for supremacy in many fields of effort—art, literature, business, politics, war, athletics, and a hundred other competitions: whatever other distinctions Connecticut has won, she was, in 1880, the undisputed leader in oyster culture.

From 1880 to 1910, Connecticut has led the world in the production of a valuable food at a time when the world is approaching over-population and when mankind have long devoted their energies to destroying the bountiful provisions of nature, as forests, buffalo, and other animals, and fishes, valuable resources which men

would carefully conserve if they were governed by intelligent foresight.

Similar lack of foresight practically destroyed the natural oyster fisheries of Great Britain and other countries, has nearly destroyed the great oyster industry of Rhode Island and has greatly impaired that of Connecticut. The industry in these two States was closely interwoven, as it was principally Connecticut planters who developed the oyster industry of Rhode Island and who paid to that State four-fifths of the great income which it received for oyster ground rentals ten years ago.

That direct income was over $135,000. per year ten years ago; now about one-tenth as much, while the oysters marketed annually from the oyster grounds of Connecticut are not now twenty per cent in amount what they were in 1914.

The reader of the following article will be enabled to form his own conclusions as to the causes of the disastrous shrinkage during the past decade in the production of this delicious and wholesome food.

Principles of Oyster Farming

There are, of course, many problems in the prosecution of the oyster industry, which require careful study, but the fundamental principles underlying all accomplishment or progress in oyster farming are so simple that even a superficial student may understand them. Unfortunately very few know anything about it.

Huxley studied the problem of oyster production in Great Britain and the principles which he laid down are equally applicable to oyster production everywhere. He came to the unquestionable conclusion that:—"The only

hope for the oyster consumer lies in the encouragement of oyster culture." He says also that:—"Oyster culture can eventually be carried on only by private enterprise, and the problem for legislation to solve, is how to give such rights of property upon those shores which are favorable to oyster culture as may encourage competent persons to invest their money in that undertaking." Every intelligent student of this industry has reached the same conclusion.

The Encyclopedia Britannica adds a footnote as follows:—

"Connecticut has greatly benefited its oyster industry by giving to oyster culturists a fee simple title to the lands under control by them," but truth will require the admission in the next edition of the Encyclopedia that Connecticut has reverted to ignorance in its legislation upon the oyster industry and has passed a law whereby instead of hereafter giving to the oyster culturist a title to the land, it now only gives a lease. This step backward is only one of a great number of statutes which, since 1912, have hampered, obstructed, and injured the oyster industry, and under which there is not now one-fifth the quantity of oysters marketed annually as ten years ago.

It is admitted among nearly all intelligent people that the principle of renting uplands to farmers instead of their permanent ownership, is a calamity to any nation where such system exists. Great Britain and other countries are making vast and expensive efforts to do away with this vicious system and get the title to land into the hands of those who cultivate it, but Connecticut, in this same period of the world's history, has reverted to the method of rack rentals which was for

centuries the main cause of the miseries of the Irish, and was an underlying cause of the chaos in Russia, and many other unfortunate peoples.

In addition to ill-considered and injurious affirmative legislation, the State has failed to prevent the discharge of chemical wastes from the factories and of fuel oils from vessels into the waters of Connecticut, thus making a large portion of the shoal water of the State unfit for bathing, and many other purposes.

This has caused the abandonment of the use of the oyster grounds near the land and has compelled oyster farmers to confine their operations to those waters which are a long distance from land where the waters retain their original purity, thus greatly reducing the production of seed oysters in this State.

History

The earliest chapters of oyster production in Connecticut are written in the ancient deposits of shells which are found on and near the banks of many of the estuaries opening into Long Island Sound throughout the coast line of the State. These deposits of shells were undoubtedly accumulated by the Indians through the centuries before the white man came, and in some localities (as for instance near the mouth of East Haven River), the writer has seen these deposits of shells several feet in thickness, covered by a deposit of soil about one foot deep, which gathered during the centuries which have passed since the Indians found a considerable item of food in the oysters which grew naturally within the bays and rivers opening upon Long Island Sound.

It is noticeable that many of the shell deposits near the rivers in Connecticut are found in places compara-

tively sheltered from winter winds, but near to the waters where the oysters grew naturally, indicating that the Indians located their wigwams in winter in these sheltered places and depended to a considerable degree upon oysters as an item of food.

Among these the writer has found many Indian relics, as pieces of pottery, arrowheads of quartz, stone sinkers for fish nets, and other objects prepared and used by the Indians. Dodd's East Haven Register, published 1824, says that bones of Indians were found in the vicinity of these deposits some of them being of men six and a half feet high.

These shell deposits are the earliest records of the use of oysters by man in Connecticut, although the fossil remains of oysters are found in many parts of the United States.

The Indian shell deposits in Connecticut, while extensive, covering in some places many acres, are small compared with those in some of the other states. In Florida, and in Maine, the aboriginal shell deposits on the river banks contained millions of bushels.

We have no knowledge that the Indians cultivated oysters as they did maize, but it is probable that they used oysters as an article of trade with tribes not located upon the water courses.

After the white man came, the oyster fishery was conducted for about two hundred years in much the same manner as by the Indians. As far as we know, planting did not begin until about 1800, although doubtless before that date oysters had become an article of traffic with the inhabitants of the inland towns.

Between 1800 and 1825 there gradually arose a business in opening oysters and transporting them to the in-

terior. This was done to a small extent from South Norwalk, Stamford, and other coast towns, but was especially developed in Fair Haven, which is now the eastern section of New Haven.

Between 1800 and 1820 and later, the oysters which grew naturally in the Quinnipiac River and in New Haven harbor, particularly Morris Cove, were stored in the basements of the dwellings and during the cold weather were opened, packed in kegs, and carried in saddle bags and sold in the interior towns.

This traffic soon increased so that the more enterprising dealers employed large "spring wagons" drawn by two and four horses and extended their trips to Hartford, Springfield, and later into northern New York, Vermont, and Canada.

These oyster caravans sold partly for cash, but sometimes returned from the northern states of New England with exchange merchandise consisting of butter, cheese, pork, brooms, Vermont grey cloth, and other articles.[1]

The early legislation of Connecticut, about 1750, permitted the individual towns on the coast to make by-laws regulating the taking of the shell fish from the adjoining waters, but there was no provision for planting or cultivation.

A system of granting permits to take oysters prevailed in some of the towns between 1750 and 1800. One of these permits was found tucked away between the kitchen ceiling and the overhead floor in the ancient Morris house near Morris Cove in East Haven, when

[1] See the article on the oyster industry by Henry C. Rowe in the "History of New Haven" published by Munsell & Co., of New York in 1887.

the wall was opened for repairs in 1920. This permit reads as follows:

East Haven, Oct. 4th, 1779.

Permission is given to Amos Morris Jun to catch two bushels of oysters within the bounds of East Haven within seven days from the above Dait.

Jonathan Auston
Committee

In the revision of the Connecticut Statutes of 1821, but one oyster section appears. It provides that the towns along the coast may make by-laws regulating the fisheries for oysters and clams, in the waters belonging to and adjoining such town. The principal use made of this power was to enact a provision for a "close season," fixing a period in each year during which no oysters should be taken. In 1830 the Legislature provided that such by-laws shall be duly published, and for appeal by those prosecuted under them. Also that no town should issue permits to any one to take oysters during the time that such taking was forbidden by the by-laws and that no discrimination should be made, but that the by-laws should apply to all persons whatsoever. The same statute provided for incarceration in the workhouse of those who failed to pay their fine under this statute.

In 1842 the "close time" which had before been regulated by laws of each town, was fixed by statute from March 1 to November 21, unless dissented from by towns in town meeting.

It may be here remarked that intelligent authorities are agreed that to enact a "close time" upon oysters, is a crude and inadequate attempt to foster oyster production. This may be seen when it is realized that

oysters require from four to seven years, in different localities, to mature, and it is obvious that to have a yearly period when open to depredation involves a vast waste of labor and of destruction of oysters.

In 1845, a statute forbade all oystering in the night season, except by the owner of planted oysters upon his own ground; and the same year the legislation took a long stride forward in providing for the staking out of ground and planting of the same, with the consent of a committee appointed by the town for that purpose. The natural oyster beds were exempted from such staking, and penalty was provided for trespass upon these beds. It had been common for many years to plant oysters temporarily to a considerable extent, but this formal authority for the practice was very necessary for the proper protection and regulation of the planting.

Rev. Stephen Dodd, in his interesting history of East Haven, called the "East Haven Register," published in 1824, says: The fisheries of East Haven are excellent and valuable. In the Quinnipiac River oysters are taken in vast quantities and those of superior flavor in the Cove and Stony River.

The rapidly increasing trade in oysters caused the importation from neighboring rivers to begin between 1800 and 1820. One of the oldest inhabitants told the writer in 1885 that the importation of oysters from the Housatonic River commenced about 1810, and that Fair Haven vessels rapidly extended their cruises further and further from New Haven to North River, Newark Bay, New Brunswick flats and a few years later to Delaware Bay, Chincoteague, and finally about 1823 to Chesapeake Bay itself. Mr. Dodd also says: "The trade in oysters is carried to a great extent. From

60,000 to 100,000 bushels are annually imported. These are opened, put up in small kegs, and dispersed all over the northern and western country and quite far into Canada. The amount of sales for this town and vicinity was estimated at $25,000 during the fall and winter season, and it sometimes probably exceeds that sum."

What seemed to this early historian a large amount, is a trifle compared with what were artificially propagated and marketed in 1878, when more than twice as many oysters were shipped in one day than were regarded a large product for a year in 1824.

Mr. Ernest Ingersoll, in his monograph on the oyster industry, in the tenth United States Census, gives a spirited account of the annual raid upon oysters which occurred upon the day when the close season terminated. He describes many pranks which were played by the Fair Haven boatmen upon the unwelcome competitors from the surrounding towns with the intention of hindering or preventing the competition of those who were regarded as intruders.

The legislation for the regulation of the oyster fisheries followed the industry itself and grew from a small beginning to a long chapter in the statutes. As different phases of the industry arose, new statutes were added.

In 1848, non-residents were forbidden to take oysters in the waters of this State, and the act provided for seizure of boats and utensils used in such taking.

In 1855 an important act was passed. The necessity of some written evidence of title to oyster grounds was seen, and it was provided that applications, designations, and transfers of ground should be in writing. But it was not till 1864 that an essential step was taken that

directed that designations and transfers should be recorded; that new designations might be taken out when the evidences of title had been lost; and for the taxation of designated grounds.

In 1865, staking out grounds, except by the committee duly appointed, was prohibited.

After that date, the growth of the business demanded frequent changes in the statutes. They are too numerous to mention here. Under these, many grounds were staked out and designations were made in lawful form within the bays and mouths of rivers and among the islands at various places, including Stamford, Norwalk, Branford, Groton, Clinton and other points, but especially in New Haven harbor where great quantities of oysters were brought annually from Chesapeake Bay in the month of April and were opened and marketed throughout the eastern and northern United States and Canada during the following Fall. Native oysters were also planted to a considerable amount in these waters.

About 1865 and 1866 the propagation of oysters was pursued to some extent; and, under various statutes for that purpose, Morris Cove was granted to individuals—a single acre to each—and, there being more applicants than there were acres, the ground was apportioned by lot. The town of East Haven received $10 per acre for the ground, but incurred much expense in the survey. The town of New Haven also granted a large territory in 1867 known as the "shoal ground," extending from near the "fort buoy" to the mouth of the harbor, and East Haven followed, in 1872, under the authority of an Act of the Legislature in 1871, by the designation of a tract of one acre lots.

The planting of oysters upon similar small tracts was also prosecuted in a limited degree in the waters of Milford, Stratford, Bridgeport, South Norwalk, Branford, and other towns, these plantations being within the harbors and estuaries, and between the islands along the coast. It was not until 1874 that extensive propagation and production of oysters was attempted outside of all rivers, bays, harbors, and islands.

Prior to this time it was not considered practicable to obtain a "set" of embryo oysters, in the deep open waters of the Sound, or to defend the right of property in these oysters; in fact, there was a general opinion that territorial or police rights of the State of New York, extended to the coast of Connecticut.

It was also the general opinion that even if oysters could be produced in the open Sound and legally protected, they would be destroyed by starfish, drills, and other natural enemies. Planters feared to undertake the outside cultivation.[2]

It would be impossible in the space assigned to this article to do more than to outline the methods of the business, the difficulties met, the risks incurred, and the means to combat them.

After a legal title has been secured, which was for many years very difficult to accomplish, the next step was to examine the bottom to ascertain its character and whether the starfish, drills, or periwinkles were present. If so, to plant the ground would be useless, for, under the most favorable conditions these enemies are liable to appear and destroy a bed of oysters at any time, and it would be almost a certain loss to locate a bed of oysters where these enemies were already present in any considerable amount.

[2] Mr. Ernest Ingersoll states in his monograph of the United States Census of 1880, as follows: "Mr. H. C. Rowe first showed the courage of his opinions enough to take up some hundreds of acres outside in water from twenty-five to forty feet deep and to begin there the propagation of native oysters."

If the conditions are found favorable, the next step is to plant a quantity of parent oysters broadcast say; 30,000 or 40,000 bushels on a tract of 500 acres.

In the month of July every adult female oyster produces several million of eggs, and every male oyster a much greater number of spermatozoa. These are discharged into the water of the Sound, and though their numbers are far beyond computation, or even imagination, yet they are so small and there is such a vast body of water in the Sound, that but a very small percentage of the eggs come in contact with the milt and are impregnated. After floating in the water for several days, the little oysters, which go through many wonderful and interesting changes, as may be seen under the microscope, are ready to attach to some shell or stone, or other hard clean substance, and settle down to a quiet life.

In July 1882, Lieutenant Francis Winslow, U. S. N., who had previously pursued an extensive scientific study of the reproduction of the oyster, in collaboration with Dr. W. K. Brooks, of Johns Hopkins University, conducted with the writer, extensive experiments in the artificial reproduction of oysters, and produced vast quantities of embryos, keeping them in receptacles at our experiment station until they had reached nearly the stage when they were ready to attach to suitable material on the bottom.

At that time Lieutenant Winslow and the writer entertained one afternoon, on a steamer which we employed in the oyster industry, a large party of the members of the Connecticut Academy of Science. We took with this party what was estimated at fifteen million of the embryo oysters which had developed nearly to the attaching stage, and on reaching the grounds about a mile from the coast where a little over a hundred thousand bushels of shells had previously been planted, we lowered these embryo oysters to the bottom in a recep-

tacle so constructed that both ends could be pulled out with a line so as to liberate these fifteen million embryos on the bottom among the shells.

A month or two later we were gratified to find a considerable attachment of embryo oysters upon the shells previously planted on this ground, although of course it was impossible for us to know how many of the "sets" secured, originated from the embryo oysters which we planted, as of course at that time there were also embryo oysters from other oysters in the waters of the Sound.

Although ordinarily but a small proportion of the eggs are impregnated, the number that reach the attaching stage, and start on the journey of life as perfect oysters, is still further vastly reduced by many destructive agencies. A cold rain will kill all the embryos with which it comes in contact, and the minute oysters are the prey of many kinds of microscopic life, especially of the infusoria. Of those that have escaped all the preceding dangers, but a small proportion are brought by the currents of water in contact with sheels or other "Culch" suitable for attachment.

The microscopic oysters must have a hard and clean substance to which to attach, and as two-thirds of the bottom of the Sound is mud and sand, and most of the remainder is almost free from shells, except where planted for the purpose, but a small fraction of the swimming embryos survive under natural conditions. But here the aid of the oyster culturist intervenes, and on the five hundred acres where he has, as stated, planted thirty thousand bushels of parent oysters to furnish the embryos, he also plants 500,000 bushels of shells in July, just at the time when the little oysters

are in need of a resting-place. These shells, being freshly planted, have not yet accumulated the obstructive deposits of tunicates, barnacles, bryozoa, polyps, etc., and if the season is a favorable one, the oyster cultivator finds on examining the shells with magnifying glass in August, little specks, which the practiced eye can later recognize as oysters, sometimes one or two on a shell, and sometimes, in former years, crowded with dozens.

These little oysters grow to the size of half an inch to an inch in diameter during their first season, and those which survive their many enemies reach a marketable age at from four to seven years.

During the whole period of growth they are subject to destruction by the starfish (Asterias Vulgaris), periwinkles, drills (urosalpinx cinerea), and by the wave action of severe storms, which agitate the water to a great depth, and often bury hundreds of acres of oysters and smother them under sand, mud, or seaweed.

But the starfish are probably the greatest enemy of the oyster. They move about the Sound with the currents, sometimes singly, sometimes in squads, and sometimes in great armies like the locusts in Africa, destroying nearly every oyster in their path. On an oyster bed of one hundred thousand bushels, half have perished in two weeks. The only certain remedy is to catch up both starfish and oysters, and, after picking out the starfish to plant the oysters on ground where the starfish are not present. Several ingenious contrivances have been invented to catch the "stars" only, and some patented. The so-called mops or tangles are extensively used.

The preceding are some of the dangers and obstacles which nature provided for the discouragement of early oyster cultivators, but the prejudices, jealousies and

mistaken views generally prevalent, added much to their difficulties. In 1880 very few were aware that oysters were cultivated like wheat or rye. Most people supposed that oysters grew wild like blueberries; consequently they regarded the granting of oyster ground to individual oyster growers as a wrong to the public, and it was with much difficulty that legislation could be secured which would enable oyster growers to protect their worthy enterprise. Demagogues harangued town meetings in some shore towns, and, getting elected to the Legislature, there announced themselves as the friends of the "poor man," and decried the pioneers in this industry as monopolists, when in fact the oyster farmers were the originators of an industry which was to cause Connecticut waters to produce five hundred times as many oysters as in a wild state, and furnish labor and food to five hundred poor men where it did to one before.

For many years the enterprise was regarded as too hazardous for extensive investment, but after the first experimental planting from 1874 to 1876, grounds used by planters were rapidly extended to points two, three and four miles from land outside of the bays, harbors, and islands where the previous oyster cultivation had existed.

In place of the canoes and sharpies which were employed in planting oysters from 1850 to 1870, there were employed in the later development of the oyster industry, large steamers capable of doing their work in water forty to sixty feet in depth, and able to do as much work in one day as the craft formerly used could do in many months. An illustration of one of the steamers accompanies this article.

These adventurous planters were ridiculed for such a hare-brained investment and it was commonly spoken of as a case of "A fool and his money soon parted." Notwithstanding many hazards, losses and difficulties, these pioneers achieved success and before 1878 the enterprise was recognized as a promising and growing industry and was rapidly developed and extended. Oysters at that time within these waters propagated much more freely and grew faster than in similar areas at the present time.

In 1881 the towns along the coast had realized large sums of money with but little expense by selling oyster grounds to the planters, in pursuance of the laws then existing authorizing such sale. For instance, prior to 1881, the town of Stratford received clear of all expense, $5,600 on a sale of about six thousand acres.

This industry having proved a success, the Legislature in 1880 created a commission so that the State instead of the towns should receive the proceeds of the sales of the grounds. It was provided that this commission might sell oyster grounds for the same price at which the towns had previously been authorized to sell, and the commission in pursuance of this new legislation procured an office, held frequent meetings and employed a clerk and an engineer.

If the business of the State had been administered upon the same economical methods as that of the towns had been, the State should have received net proceeds to the amount of $45,000 on the sale of the next seven years. But on investigation in 1888, it was found that the business of the State had been transacted in so extravagant a manner that instead of netting $45,000 the State had lost $45,000.

A summary of the official reports showed the following figures:

Cost of Commission, its employes and expenses to June, 1888		$84,647.15
Total proceeds sales of ground and engineering same	$57,091.00	
Deduct for worthless ground returned to the State	18,247.40	
		38,843.60
		$45,803.55

At a legislative investigation in 1888, it appeared that each meeting of the commission cost the State thirty dollars, and that their pay was drawn, according to the reports of the commissioners, for nearly every work day of the year. Also that the expenditures for the clerk of shell fisheries and the engineer were of extravagant proportions, so that, although the oyster growers had paid the State over $57,000 for grounds, instead of net proceeds there was a loss of over $45,000.

It was claimed, however, that some part of this great expense was attributable to the mapping of oyster grounds previously granted. On the other hand, it was shown that most of the grounds previously granted were already adequately mapped, and that the total expense authorized by law for mapping these grounds was $1,500, while the surveying and mapping of the grounds designated after 1881, was paid for by the purchasers. The Legislature after a long and exhaustive hearing, cut down the annual appropriation for the commissioners from $13,500 per year to $4,400.

The oyster industry had, however, grown very rapidly up to the time of the inception of the commission in

1881, and from that time until 1885 the growth continued, and although at a much slower rate, until about 1890. This was not *because* of any encouragement or assistance by the commission, but rather *in spite* of the hindrance and obstructions created by it.

It may easily be seen that an expensive bureaucracy was established and maintained by the State which resulted not for the benefit of the oyster industry, but for the financial benefit of political appointees and their associates.

There has been, throughout the whole history of this industry, a misapprehension in the public mind as to its nature, and as to the economic policy which should be observed by state authority. Oyster farming in the deep waters of Long Island Sound is strictly analagous to farming on land and it is just as much public policy to foster and encourage the growth of oysters under water as it is of crops on the upland.

This problem has not been understood by the public, nor even by the judges of our courts. The rights of property in planted oysters have not, in many cases, been sustained in the courts as they ought to have been.

The oyster farms, being situated miles from land, and it being lawful to sail over these grounds at any time of day or night, it is very difficult to protect a property so situated or to detect theft of oysters under such conditions.

There are a large number of men located along the coast who do not plant oysters or expend anything to produce them, but who sell large quantities, sometimes in the State of Connecticut, and sometimes after transporting them in their boats to other states.

Some of these men undoubtedly make a practice of

taking large quantities of artificially-produced oysters from the grounds of the planters. Under the existing conditions, they may do this successfully, especially by night, for months and years. When, however, one of them is detected in the act, judges who do not understand the real situation, are easily induced to acquit such men upon the general, but hazy, impression that oysters are free plunder.

The same judges who would convict a man for stealing a bushel of potatoes from a farmer or a loaf of bread from a bakery, will fail to convict for theft of oysters, although committed by one who has sold oysters for years without ever having done anything to produce them himself, and has very likely pursued the occupation for a long period and has even been previously prosecuted for the same crime.

This is another of the great difficulties which have been encountered by the oyster growers and which have contributed to the discouragement of the oyster industry. It is stated that many cases of theft by such trespassers have not been prosecuted in the State of Rhode Island because political influence was enlisted to secure acquittal.

As we have shown, oysters for many centuries were produced naturally in certain limited locations in Connecticut waters, but it has not been understood by the general public that five hundred times as many oysters can be produced by cultivation as are produced naturally.

Between 1908 and 1918, many errors of legislation were enacted, discouraging to the oyster industry, and obstructive to its prosecution; for instance, a special tax which was laid upon oyster grounds for the purpose of

defraying the cost of a state police, was so employed for a long period of years, but the police were finally abolished by statute, although at the same time the special tax was not repealed, but instead, an increased tax was placed upon oyster ground. Assessments were also excessive. Oyster grounds that were assessed for $5,000 were offered for sale for $500 or even $250. Of course under such exorbitant assessments, neither upland or water farms could be maintained.

There is not here available space to enumerate the many ill-considered statutes based upon incorrect information which were passed during the ten years prior to 1920. Within the last few years, some slight amends have been made by the passage of some statutes intended to encourage the industry, but these are of a somewhat paternalistic nature, which is not necessary.

From 1875 to 1885 the business developed without paternalistic legislation, and none is needed now. It is true that farmers on land are encouraged and assisted by Federal and State appropriations of many millions of dollars annually. Swimming fish are propagated at public expense, for the benefit of the fisher and angler by both State and Federal governments, but no such provisions are desired in the case of oyster culture. All that is needed is to restore the conditions of legislation which existed from 1875 to 1880 and some few later statutes, which will, as far as practicable, protect the oyster farmers in the product of their own labor. If the legislative and natural conditions should be restored as they then existed, there is still a chance for a revival of this great food-producing industry.

The recent researches of French scientists and of the United States Department of Commerce have proved

that oysters are not only rich in many of the most necessary food elements, but supply abundance of vitamines; hence the encouragement of their production is important to promote public health as well as an obvious public policy in the increase of the food supply.

During the past three years some improvement has been attained in the diminution of the discharge of chemical wastes. Another encouraging circumstance is that the public intelligence is slowly commencing to realize that the interest of the consumer demands the encouragement of food production, and forbids it being exploited by selfish politicians.

SUMMARY OF CONNECTICUT INDUSTRIES

THE following table is a condensed summary of the 82-page booklet compiled by the Factory Inspection Department of Connecticut and entitled "List of Connecticut Manufacturers and Their Products." This summary includes small as well as large manufacturers.

A recapitulation of the column headed "number of manufacturers" shows a total of 3,968 for the State, while the column headed "number of employees" shows a total of 297,252.

The table that follows indicates that New Haven leads the entire State in the "Number of Manufacturers"—550. Hartford is a close second with 542 and Bridgeport a close third with 523, while Waterbury is fourth with a figure of 174.

The table further indicates that Bridgeport leads the cities of the State in "Number of Employees" with a figure of 40,344. Hartford comes second with 28,530, while New Haven is a close third with a figure of 28,339. Waterbury is fourth with 22,896.

Furthermore, the table shows that New Haven leads the cities of the State in "Different Kinds of Manufacturing," with a figure of 250. Bridgeport comes second with 197, and Hartford follows with a figure of 171, while Waterbury shows 104.

From the standpoint of "Number of Manufacturers" the first fifteen cities of the State are as follows in the order of their size: New Haven (550); Hartford (542); Bridgeport (523); Waterbury (174); New Britain (122); Danbury (118); Stamford (105); Norwich (98); Meriden (95); South Norwalk (88); New Lon-

don (78); Norwalk (56); Middletown (52); Winsted (42); Bristol (36).

From the standpoint of "Number of Employees," the first fifteen cities of the State are as follows: Bridgeport (40,344); Hartford (28,530); New Haven (28,-339); Waterbury (22,896); New Britain (18,519); Meriden (9,136); Stamford (9,002); Bristol (6,908); Torrington (6,370); Danbury (6,075); Ansonia (5,635); Norwich (5,581); Naugatuck (4,644); South Manchester (4,429); Shelton (4,304).

From the standpoint of "Different Kinds of Manufacturing" the leading cities of the State are as follows: New Haven (250); Bridgeport (197); Hartford (171); Waterbury (104); Stamford (77); Meriden (63); New Britain (60); Norwich (57); South Norwalk (55); Danbury (52); New London (51); Middletown (38); Norwalk (36); Derby (33).

City or Town	Number of Manufacturers	Number of Employees	Different Kinds of Manufacturing
Addison	1	15	1
Andover	1	18	1
Ansonia	21	5,635	16
Attawaugan	1	345	1
Avon	1	161	1
Baltic	6	725	6
Bantam	5	287	3
Beacon Falls	3	997	3
Berlin	7	291	7
Bethel	21	486	16
Botsford	1	22	1
Bozrahville	1	7	1
Branford	10	1,164	10
Bridgeport	523	40,344	197
Bristol	36	6,908	28
Broad Brook	10	469	3
Buckland	4	335	4

City or Town	Number of Manufacturers	Number of Employees	Different Kinds of Manufacturing
Burnside	4	238	3
Burrville	1	3	1
Canaan	6	103	6
Canton	1	33	1
Center Brook	2	56	2
Central Village	4	258	3
Cheshire	2	128	2
Chester	11	241	9
Clinton	3	110	3
Colchester	5	122	3
Collinsville	7	531	7
Comstock Bridge	1	14	1
Conantville	1	21	1
Cornwall Bridge	3	14	3
Cos Cob	4	280	4
Cromwell	4	61	4
Danbury	118	6,075	52
Danielson	19	1,133	16
Darien	2	12	2
Dayville	2	341	2
Deep River	8	703	7
Derby	34	1,476	33
Durham	2	44	1
Eagleville	1	75	1
East Berlin	3	42	3
Eastford	2	19	1
East Glastonbury	1	140	1
East Haddam	2	15	2
East Hampton	15	544	9
East Hartford	26	1,168	16
East Killingly	5	267	4
East Portchester	14	300	10
East Windsor Hill	6	117	1
Ellington	5	50	2
Elmville	1	71	1
Elmwood	6	721	5
Essex	4	87	4
Fabyan	1	37	1
Fairfield	13	1,618	13
Falls Village	1	10	1

City or Town	Number of Manufacturers	Number of Employees	Different Kinds of Manufacturing
Farmington	3	41	3
Fitchville	1	250	1
Forestville	15	1,281	10
Georgetown	1	440	1
Gildersleeve	2	29	2
Glasgo	1	—	1
Glastonbury	7	484	6
Glenbrook	4	151	3
Glenville	3	354	3
Goodyear	1	360	1
Greenwich	30	668	15
Groton	8	871	8
Guilford	11	157	11
Gurleyville	2	7	2
Hadlyme	1	—	1
Hamden	7	293	7
Hanks Hill	1	3	1
Hanover	1	105	1
Hartford	542	28,530	171
Hawleyville	4	82	4
Hazardville	5	169	4
Higganum	6	185	6
Highland Park	1	90	1
Hop River	1	8	1
Ivoryton	3	501	3
Jewett City	10	1,335	9
Kensington	1	296	1
Lakeville	1	5	1
Lime Rock	2	112	2
Litchfield	4	17	4
Little River	1	27	1
Long Hill	4	38	4
Lyme	3	42	3
Manchester	18	1,132	14
Mansfield Center	1	32	1
Mansfield Depot	1	8	1
Mechanicsville	3	408	3
Melrose	2	30	1
Meriden	95	9,136	63
Merrow	1	3	1

City or Town	Number of Manufacturers	Number of Employees	Different Kinds of Manufacturing
Mianus	3	163	2
Middlefield	1	36	1
Middletown	52	3,499	38
Milford	19	445	17
Milldale	4	205	4
Millstone	1	6	1
Montville	10	946	6
Moodus	11	219	6
Moosup	6	993	6
Mount Carmel	4	79	4
Mystic	23	914	19
Naubuc	1	6	1
Naugatuck	15	4,644	12
New Britain	122	18,519	60
New Canaan	8	43	8
New Hartford	1	200	1
New Haven	550	28,339	250
Newtown	4	17	4
New London	78	2,996	51
New Milford	19	509	15
Niantic	4	164	4
Noank	3	88	3
Norfolk	1	30	1
Northfield	1	23	1
North Grosvenordale	1	1,100	1
Norwalk	56	3,454	36
Norwalk, East	13	223	13
Norwalk, South	88	4,223	55
Norwich	98	5,581	57
Oakdale	2	125	2
Oakville	5	1,006	4
Oneco	1	11	1
Packerville	1	5	1
Pawcatuck	10	1,140	9
Perry's	1	154	1
Pine Meadow	2	123	2
Plainfield	4	970	4
Plainville	28	1,163	22
Plantsville	10	464	5
Poquonock	2	233	2

City or Town	Number of Manufacturers	Number of Employees	Different Kinds of Manufacturing
Poquonock Bridge	2	293	2
Portland	10	309	9
Putnam	34	2,214	28
Rainbow	2	60	2
Rockfall	3	176	3
Riverton	2	29	2
Rockville	28	2,618	26
Rocky Hill	1	140	1
Rowayton	1	17	1
Salisbury	2	8	2
Sandy Hook	4	139	4
Saugatuck	6	56	5
Saybrook	3	60	3
Seymour	17	1,621	16
Shelton	29	4,304	28
Silver Lane	3	245	2
Simsbury	1	368	1
Somersville	1	349	1
Southington	12	1,439	8
South Coventry	9	146	7
South Glastonbury	2	181	2
South Manchester	18	4,429	13
South Windsor	3	60	1
Southport	3	54	2
Springdale	9	414	9
Stafford	4	35	4
Stafford, West	2	4	2
Stafford Springs	17	1,382	12
Staffordville	2	144	2
Stamford	105	9,002	77
Stepney	1	8	1
Sterling	1	306	1
Stonington	6	673	6
Stratford	26	453	23
Suffield	10	388	2
Taftville	5	1,932	5
Talcottville	1	180	1
Tariffville	7	167	4
Terryville	5	1,508	5
Thomaston	12	1,192	8

City or Town	Number of Manufacturers	Number of Employees	Different Kinds of Manufacturing
Thompsonville	11	3,978	10
Tolland	1	3	1
Torrington	30	6,370	22
Tracy	1	87	1
Uncasville	1	110	1
Union City	2	340	2
Unionville	16	533	15
Vernon	1	125	1
Versailles	5	389	5
Voluntown	1	210	1
Wallingford	31	3,403	23
Warehouse Point	3	96	3
Washington	2	16	2
Waterbury	174	22,896	104
Waterford	4	87	4
Watertown	5	609	4
Waterville	7	3,223	7
Wauregan	1	564	1
Weatogue	1	58	1
Westbrook	3	48	2
West Cheshire	2	115	2
West Hartford	4	33	3
West Haven	29	1,131	28
Westchester, North	2	20	2
Westport	14	299	13
Westville	6	817	6
Wethersfield	5	560	4
Willington, South	2	187	2
Willington, West	6	109	1
Willimantic	28	3,739	22
Wilsonville	1	50	1
Windsor	15	468	9
Windsor Locks	15	830	11
Windham, North	4	34	4
Windham, South	2	68	2
Winsted	42	2,016	27
Woodland	1	72	1
Woodbury	2	62	2
Yalesville	2	12	2
Yantic	2	311	2

A Few High Spots of Connecticut Industry

In 1923, Connecticut manufacturers turned out products valued at $1,288,293,000 according to the records of the Department of Commerce and obtained through the biennial census of manufacturing conducted in 1923. The foregoing value represents factory prices and it shows an increase of 54.1% over the 1921 value of Connecticut's manufacturing output.

The Department of Commerce records indicate that Connecticut's leading industry is the manufacture of "brass, bronze and other non-ferrous alloys" irrespective of whether it is measured by the number of wage earners employed in it—23,000 in 1923 compared with 15,373 in 1921—or by the value of the products—$164,-367,673 in 1923. This industry also showed the largest increase of any Connecticut industry in the two-year period from 1921–1923. This industry's increase in wage earners was 49.6% and the increase in production was 149.8%.

Wage payments made to industrial employees in Connecticut were $221,126,000 in 1921 and $314,000,000 in 1923—an advance of 42.4% in the two years. Part of this advance is explained by the increased number of employees and part by higher wages.

BIBLIOGRAPHY

Current histories of Connecticut, notably: "General History of Connecticut," Dr. Samuel Peters, 1781; "History of Connecticut," Theodore Dwight, 1841; "Historical Estimate of Connecticut," Rev. Horace Bushnell, 1851; "History of Connecticut from its Earliest Settlement to the Present Time," W. H. Carpenter, T. S. Arthur, 1872; "History of Connecticut," Elias B. Sanford, 1889; "Connecticut," Alexander Johnstone, 1900. "American Commonwealths" series, edited by Horace E. Scudder; "Connecticut as a Colony and as a State," 4 volumes, Forrest Morgan, editor, 1904; "A History of Connecticut," George L. Clark, 1914; "Connecticut in Transition, 1775–1818," Richard J. Purcell, 1918. "Dwight's Travels," 1823.

Washington's Diary of his trip through New England as President.

"Gazeteer of the States of Connecticut and Rhode Island," John C. Pease and John M. Niles, 1819.

"Historical, Statistical and Industrial Review of the State of Connecticut," published 1883.

"Leading Manufacturers and Merchants of Connecticut, Illustrated, Historical and Descriptive Review of Industrial Enterprises of Hartford, New London, Windham and Middlesex Counties," 1887. Published by International Publishing Co., New York.

Various City, Town and County Histories, notably: Rev. Joseph Anderson, History of Waterbury, 1896. D. Hamilton Hurd, History of Fairfield County, 1881.

Reports of state bureaus of Labor Statistics (especially 1902 Black) State Department of Factory Inspection, etc.: United States Census Reports, Manufacturers, United States Government Bulletins.

Connecticut Quarterly Magazine, later Connecticut Magazine, special articles on Connecticut industries and institutions.

"Great Industries of the United States, being a Historical Summary of the Origin, Growth and Perfection of the Chief Industrial Arts of the Country," 1872, (By Horace Greeley, Leon Case and others.)

"History of American Manufacturers," two volumes, James Leander Bishop, 1864 (especially valuable).

"Early Silver of Connecticut and its Makers," George Munson Curtis, 1913.

"History of the Bolt and Nut Industry of America," W. R. Wilbur, 1905.

"The Brass Industry in Connecticut," William G. Lathrop, 1909.

"English and American Tool Builders," Joseph Wickham Roe, 1916.

Statistics of the Condition and Products of Certain Branches of Industry in Connecticut for the year ending October 1, 1845, Daniel P. Tyler, Secretary of State, 1846.

Connecticut Manufacturers and Products, also Partial List of Idle Factories, issued by George L. McLean, Factory Inspector.

"Time Telling Through the Ages," Harry C. Brearley, published by Doubleday, Page & Co., for Robert H. Ingersoll & Bro., 1919. Comprehensive volume of clock and watch industry commemorating the twenty-fifth anniversary of the entrance of that company into the industry.

"America's Munitions, 1917–1918," report of Benedict Crowell, Assistant Secretary of War, Division of Munitions, 1919.

"History of American Clock Business for the Past Sixty Years, and Life of Chauncey Jerome," written by himself, 1860.

TRANSPORTATION

By William A. Countryman

Newspaper man and statistician. He began his newspaper life on the New Haven Register as city editor in 1870, going thence to the New Haven Union and the New Haven Palladium. In 1883 he became dramatic, literary and legislative editor of the Hartford Post, rising to managing editor and finally to editor-in-chief. In 1900 he went to Washington, D. C., as statistical expert in the Bureau of Census, having primarily in the nineties served as chief clerk of the Connecticut Bureau of Labor Statistics. In 1922 he retired and has since resided in New Haven. Mr. Countryman has also been Assistant City Clerk of New Haven and a Councilman and Alderman of the City of Hartford, at one time being president of the Board of Councilmen. He studied law at Yale in the class of '74.

THE stage coach era began in the 18th century but did not reach its height in Connecticut until after 1840. Even following that year there were regular coaches over long distances for the transportation of both passengers and freight, and today there are ten towns depending for regular transportation facilities upon the stage coach. In several other towns this same old method of communication is used alongside of both steam road and trolley, to connect with trains and in competition with the auto-bus.

As late as 1869 a stage coach carrying the mails ran from New Haven. It was the Hartford Stage via Fair Haven, Durham etc.

Ferries were an absolute necessity in the early days of travel whether by steam coach or steam railroad—as necessary as improved turnpikes and toll bridges when these could be provided. Early settlers pontooned across the rivers, creeks and shallows of Connecticut, or poled themselves around or over the turbulent waters, or rowed in shallops. There are instances in times not so far remote when crossings were made in ordinary row-boats. Ferry boats followed the canoe and flat boat and there is much comment to be found in the early prints about poling over the Falls at Enfield.

Sailing Vessels

Transportation by sailing vessel which in early days was important is today relatively negligent in Connecticut, even for coastwise water borne transit. Good roads have developed, many motor truck lines hauling immense quantities of goods and materials to market without utilizing even the steamboats or railways for

any part of the haul. These same good roads have multiplied automobile tourist travel, thus further injuring the water and rail traffic.

Connecticut's sail packets in speed and accommodations were equal to any in the world. Many were sloops of from 75 to 100 tons burden, being of that size to avoid the payment of the greater dockage and pilotage in New York for heavier vessels. These packets carried passengers as well as freight, all coastwise travel being by these vessels until steamboats entered the field. The freight carried was that for quick transportation, the heavier freight being carried by larger vessels.

Sloops ascended the Connecticut River in 1819 to a point just below Warehouse Point, sixty-four miles from Saybrook. This was when the water was high. The Housatonic River was navigable to Derby, twelve miles from its mouth, and boats ascended to Southbury at times of high water.

There were sealing vessels sent to the Pacific from New Haven prior to 1815, and in 1820 a company was formed to undertake whaling fisheries, the "Henry" and "Thames" being sent to the North Pacific in 1822. They came back loaded but prices were so low that the company lost money and discontinued business. The New Haven company had feared that no whales would be left in the Pacific, so numerous became these enterprises. It is notable that the "Thames" took out from New Haven the second band of missionaries to leave America for the Sandwich Islands. This company numbered eighteen, including three South Sea Islanders who had been educated in New Haven. They left Tomlinson's wharf December 19 for Owyhee, Hawaii.

From 1800 to 1830 was the era of the sail packet.

Numbers of these boats ran between Hartford and Providence, R. I. in 1825, in some instances being operated in connection with stage coaches. At that time stage coaches were the chief means of land travel, and by the combination through lines were established. The improvement of the turnpikes assisted much in this travel until the railroad entered the field. Many years after the steamboat came into its own the packets continued as freight boats. Up to the beginning of the present century packets were still employed for package freight.

The whale fishery that has made New London famous began with its large transportation of whale oil and blubber in the last decade of the 18th century. These whaling vessels included shipping of all sizes from the three-decked ship to the diminutive but rakish schooner. In 1830 six large firms and 50 vessels were actively engaged in the industry. In 1846 this total had increased to 72 and the tonnage was over 26,000. These supplanted vessels engaged in the West India liquor trade. Whaling was co-operative, the compensation of the seamen being based on the catch and the yield and price of the oil. This also was the day of small investments of individuals in ship ownership so as to avoid the great risk of disaster. Thirty-seconds of the costs of the ships were parceled out to a host of investors who became deeply interested in the success of the enterprises. At one time there were 2,500 seamen on the whalers and the capital aggregated $2,500,000.

Steamboats

It was in the year 1815 that the first steamboat came up Long Island Sound to New Haven. This was the

famous "Fulton." It looked more like a steam yacht of today than the steamboats that followed it for many years afterwards for it had a foremast and a sail so that if the steam gave out dependence could be placed on the wind to make port. The side wheels were not inclosed and there were no mufflers to the enormous cog-wheels so that not only were the paddles wholly visible to the wondering people on the shore but the terrible roar of steam and paddles roused everybody within hearing distance. "Oh, see what's coming on wheels in the water," was a frequent exclamation as the boat moved slowly along. This first trip up the sound was made March 21.

The "Fulton" was sloop-rigged, and had one mast with sails to accelerate her speed. She was 134 feet long with a 26 foot beam, had rails along her sides; measured about 30 feet outside her guards and was of 327 tons burden.

The great legal fight which forever settled the question of the control of navigable waters of the United States began about 1822 when the New York legislature gave Fulton and his wealthy colleague and backer Livingston a monopoly of Long Island Sound. As Fulton held a patent for operating vessels by steam none not licensed by his firm could traverse New York waters. Another steamer the "Connecticut" had been put on between New York and New Haven while the "Fulton" was running from New Haven to New London. As these were in opposition to the sail packet lines the packet owners induced the Connecticut legislature to enact a law that no vessel bearing the Fulton license should enter any of the waters within the state.

June 1, 1822 it was announced that steam communica-

tion between New York and New Haven had ceased. The "Connecticut" after that ran into Providence and the "Fulton" also, arriving from Pawcatuck. Until the embargo was lifted the Connecticut steamboat not licensed by Fulton ran as far as Byram's Cove, Greenwich, on its way to New York, that being the boundary line between the litigious states, and the journey was completed by stage.

The final decision in Gibbons vs. Ogden was rendered in March, 1824, the U. S. Supreme Court reversing the Court of Errors of New York, and declaring the act of the New York legislature unconstitutional. The Fulton owners had in 1822 put on a line of sailing packets from New Haven to Oyster Bay, L. I. to avoid the retaliatory act of Connecticut. At Oyster Bay connection was made by steamer to New York. A relic of this is the "ferry" now being operated from Greenwich to the same point. The decision of the United States Supreme Court at once opened the way for all sorts of experimental steamboat lines. The New Haven Steamboat Company had been organized in 1821.

The well-known steamer "Traveler" was built for Commodore Vanderbilt in 1845 and ran from New Haven for many years, within the recollection of many now living. She was considered much above the average in speed and was the day boat that carried the mail until the line was temporarily withdrawn in the fall of 1849 by an agreement with the New York and New Haven Railroad Company. The payment was $20,000 a year for five years for closing the day line. Occasionally a boat would be put on but only for a few months. In the spring of 1849 the "Commodore" was put on as a day boat for the Hartford and New Haven railroad but

in the following January it was withdrawn, and sold soon afterwards to the Stonington line. The "Connecticut" was put on also for a short time but also soon sold to the Stonington line. She was afterwards used for towing canal boats on the Hudson River. A fast boat, she was said to have made the trip between New Haven and New York in four hours. "But this," comments an early writer, "is altogether unlikely."

In November, 1850, Chester W. Chapin of Springfield bought the "Traveler" and the "Champion" from Vanderbilt for the New York and New Haven railroad. He also ran the "Traveler" as the night boat from New Haven and the "Champion" for awhile from New Haven to Hartford. This was a rare experiment—taking freight by water from New Haven to Hartford and return. In 1856 the "Elm City" was built for the New Haven Steamboat Company and began as a night boat running alternately with the "Traveler." In 1861 the well-known "Continental" was built. It was the largest boat on the line and considered the fastest of all the side-wheel boats. The "Traveler" then having outlived its usefulness became a spare boat. "Continental" was the day and "Elm City" the night boat. In 1873 the "C. H. Northam" was constructed and operated as a day boat with the "Continental." November 4, 1877 the "Northam" was laid up for repairs and in November 27 while lying at her dock was burned to the water's edge. Rebuilt and improved she ran on the rocks off Blackwell's Island December 27, 1881. August 5, 1898 her crank pin let go and she was afterwards used only as a spare boat. In 1892 was built the "Richard Peck" the first boat of the line with screw propeller and of steel construction. In June, 1899 the New

EARLY AND MODERN TYPES OF TRANSPORTATION

Canal to Farmington

Hydroairplane

Stage Coach

Haven Steamboat Company established the "Narragansett Bay Line" and extended the route of the New Haven boats to Providence, R. I. The boats operating were the "Richard Peck," "Shinnecock" and the "Lincoln." The "Northam" had been in collision a week before the opening and her place was taken by the "Chester W. Chapin."

It was in May 1900 that the New Haven Line passed wholly to the control of the New York, New Haven and Hartford Railroad Company and there have been no night passenger boats since. About 1920 the regular passenger traffic was entirely dropped between New York and New Haven. In 1903 the well-known Peck Slip landing place in New York was changed to Pier 40, North River.

In 1892 the fare from New Haven to New York by the steamers "C. H. Northam" or "Continental" was 75 cents or $1.25 for the round trip, good for six days. In 1900 as a result of friendly negotiations the entire capital stock of the New Haven Steamboat Company and its outstanding bonds amounting to $364,500 were assumed by the New York, New Haven and Hartford Railroad Company as a part of the purchase price. The directors of the railroad company in the annual report to the stockholders in which this purchase was mentioned stated that the Steamboat Company's "valuable franchise, its dock property and location in New York and its ability to deliver freight in that city promptly have for several years made its ownership desirable as an adjunct of our company."

Since the introduction of the "Fulton" into Connecticut waters great improvements have been made in the steamboat. Steel has taken the place of wood in the hull

and other parts; feathering paddles or screw propellors have superseded the cumbersome radial wheels; compound and triple expansion engines lying low in the hull have taken the place of the stately single-cylinder overhead beam; electric lights glow where once candles or ill-smelling kerosene lamps held sway; and wireless telegraphy now puts the vessel in constant communication with the shore at all times. In the old days heat was furnished by stoves in the grand saloon and passengers had to break the ice in their water pitchers.

The Starin Line of steamers first made their regular trips between New York and New Haven at the time of the opening of the New Haven and Derby Railroad in 1871. By an arrangement with the parties controlling the approaches to Union or Long Wharf permission was given the railroad to operate freight cars drawn by horses from the railroad station at the foot of Meadow street on West Water street to the Starin Wharf. Here freight was forwarded to New York. The Starin line began its first great passenger business by running excursions to Glen Island, a once famous resort on Long Island Sound near New York. This excursion business was long continued but the destruction by fire of the Steamer Slocum in Hell Gate with great loss of life led to severe restrictions upon excursion steamers and rendered the business unprofitable. The Starin Line carried passengers to and from New York until about 1920. Now nothing but package freight is taken. The line has a bevy of motor trucks which go up the state collecting packages. The "Starin" and the propellor "Erastus Corning" were the early boats on the line. January 26, 1924 a new steamer the "Yale" was added to the fleet which leaves New Haven from the foot of Brown street.

This boat is a steel twin screw oil-burning steamer with two triple-expansion engines with all the modern improvements. She measures 230 feet in length, with a beam of 45 feet, a draft of 12 feet, having stowing space for 55 freight car loads. Her gross tonnage is 1,670 and net, 1,136. The power of her twin screws will break ice ten feet thick so that she can make the harbor in any kind of weather. Her advent is notable on the Sound for she is the first oil-burner to run regularly through the Sound from New Haven to New York.

The broad Connecticut furnished ample means of communication for the river towns, and in the year 1822 any restless persons who were opposed to sailing against head winds to get there, could take the Steamboat "Experiment," Captain Haskell, on Tuesdays and Fridays at Hartford and go down to the several towns below as far as Saybrook, returning on the following days. The "Experiment" at one time also went to New York. This was the first boat built on the Connecticut and was originally intended for a tow boat. The Connecticut Steamboat Company was its owner and John L. Sullivan its inventor. It had a "new kind of steam engine," was 70 feet long and 17 feet wide. It was launched in Hartford in November 1818, and made its first trip July 16, 1818 at the rate of six miles an hour. A gas fire made from fat was found a very useful auxiliary to the wood. Financial difficulties led to abandonment of trips but afterward they were resumed to Saybrook and continued to New London, two trips a week being made.

Immediately after the embargo on steam navigation in New York waters had been raised by the decision of the United States Supreme Court the Connecticut Steamboat Company had built for itself the "Oliver Ells-

worth" named after the eminent jurist. This was the first boat to run between Hartford and New York with various landings along the river front. It was of 227 tons and had berths for 60 passengers but no staterooms. The "Macdonough," named after the famous hero of Lake Champlain in the war of 1812 was added. Macdonough after his retirement lived in Middletown. These boats began running in 1824 making trips on alternate days. In 1830 the "Charter Oak" was put on. It was the first boat to be equipped with state rooms. A competing line compelled a reduction of rates so that a person could get to New York for $1 and "found." After four seasons the opposing line with its "Water Witch" as a day boat withdrew having also tried the experiment of raising rates to $2 and leaving Hartford at night instead of 6 a. m. The "Water Witch" was said to be Daniel Drew's first venture in steamboating. The "Bunker Hill" was another famous boat running out of Hartford. It belonged to the Sanford Line. It was the Hartford Steamboat Company incorporated in 1824 that operated the "Macdonough," and the "Water Witch" as a part of the Vanderbilt interests as well as of Drew. The Steam Navigation Company, incorporated in 1825 put on the "Commerce" so that with all these contending interests there was steam navigation in extenso on the lower waters of the Connecticut. About 1827 steamboats ran from Hartford to Sag Harbor, L. I. and to Norwich, the "Victory" running as an opposition line. It was stated that the three boats carried 2,000 passengers a week. In 1851 Col. Charles H. Northam of Springfield bought out the Connecticut Steamboat Company and in the following year he sold it to the Hartford and New York Steamboat Company, this

company being chartered in 1877 as the Hartford and New York Transportation Company.

The Steamer "Silver Star" was bought of the Government at the close of the Civil War and placed on the route between Hartford and Saybrook. The engineer had also been employed by the government and loved to tell of the conferences held in the President's stateroom between Lincoln and Grant. The "Silver Star" left Essex every morning at 5 o'clock, except Monday, when she started from Saybrook at four. She was scheduled to make Hartford by 10 o'clock. She usually carried about 150 passengers and a large amount of freight; this was before the Valley Road was opened. During the winter when the river was closed residents of Saybrook and vicinity who wanted to get to Hartford had to take the Shore Line to New Haven and the Hartford road to their destination.

Hartford now has but one steamboat line. It is owned by the New York, New Haven and Hartford Railroad Company but the corporation is still known as the Hartford and New York Transportation Company. There are daily boats during the open season and both passengers and freight are carried this being, with the exception of the New London line, the only line taking passengers regularly for New York.

The United States Reports separate the navigation on the Connecticut into that below Hartford and that above. The history of water traffic above Hartford is of interest because of its past; it has no present to speak of and no future. Early in the steamboat experimental days the "Ledyard" named after John Ledyard the Connecticut-born traveller went up the river from Hartford to Wells River, Vt. but stranded there on a bar and

couldn't get to its destination, Barnett. It returned to Springfield, Mass. and towed freight boats. The "Barnett" built at New York of the wheelbarrow type for the Connecticut River Company in 1826 with a draft of less than two feet was towed up by the "Macdonough" and in December started up the river for Barnett, Vt. with a barge in tow, on which were officers of the company and guests. Peals of musketry greeted her as she approached Warehouse Point. Her engines as noisy as the Fulton's were heard a great way off and attracted much attention. Unfortunately she could not get through the Enfield Rapids for wind and tide and the heavily laden barge impeded her progress. She had to go back to Hartford and take a second start a day or two later. Then she got as far as Bellows Falls, Vt. but was too big for the locks and had to return. At Hartford there was a big celebration of all these events at John Morgan's Coffee House. This Morgan was an ancestor of the famous Morgan bankers of New York. Further attempts were made to reach Barnett. The "Blanchard" launched in 1828 with a capacity for 60 passengers got through the rapids at Enfield all right but could go no further. The "Vermont" in 1829, a stern wheeler, drawing only a foot of water, made Windsor, Vt. but could go no further. Later she plied regularly from Hartford to Springfield, Mass., the "Blanchard" also doing this. These boats ran between these two ports until the opening of the railroad between Hartford and Springfield in 1844. The famous "Massachusetts" had been added to the fleet. She had a deck cabin and a double engine and was supposed to be the latest in luxury until the great observer Dickens of London, England made the trip from Springfield to Hartford on her

in 1842. The novelist discoursed of her in his "American Notes." This famous boat was burned at her wharf in Hartford in 1843.

Although the passenger traffic was discontinued upon the introduction of the railroad the freight towing business continued to thrive for some years with regular daily service between Hartford, Springfield, Northampton, South Hadley and Greenfield; and up-river freight, as it offered, to Brattleboro and Windsor, Vt.

The general government in 1924 was preparing to deepen the Connecticut River between Hartford and Springfield so that coal-laden canal boats could be towed up. The plan was to make a depth of seven feet at Windsor Locks and provide means of getting through the locks.

The navigation of the Housatonic River was accomplished by the Naugatuck Steamboat Company from Shelton and Derby to New York up to within a comparatively few years. The early line was that operated by the Naugatuck Transportation Company prior to 1857.

The "Nimrod" began running from Bridgeport to New York about 1833 and the "Fairfield" in 1838 during the summer. The Housatonic Railroad opened in part in 1838 was not completed until 1842 and it was the "Nimrod" that ran in connection with this road for some years. The "Cape Charles" transferred passengers from Oyster Bay, L. I. and the Long Island railroad to Wilson's point, at Bridgeport, there connecting with the Housatonic, and also with the New York and New England for the east. The Housatonic road in 1848 bought the steamer "Majorie" and ran it for its own through water-traffic. This continued until 1853.

The "Bridgeport" however was the first boat of any size running regularly to New York from 1857 to 1889.

Most of the Connecticut ports however have occasional excursions to and from the great city in the summer season, and some almost continuous "ferry" service across the sound or to near-by landing places.

Greenwich has a steamboat line to Oyster Bay, L. I. carrying much freight, automobiles and other vehicles—aggregating in value $11,140,000 as reported for 1922. Norwalk has a summer line to Oyster Bay and Bridgeport has one to Port Jefferson, New London coming in too, the last with a boat to Sag Harbor and Greenport, L. I.

Every harbor or little landing place has its harbor master or assistant. These include Greenwich, New Haven, Stamford, Hartford, Middletown, New London, Norwalk, Milford, Stonington, Norwich, Stratford, and Southport, which is in the town of Fairfield. Wethersfield, a once famous port, has also been honored recently by this species of protection for craft of all kinds, little and big.

The first steps towards absorption of the Sound Lines by the New York, New Haven and Hartford Railroad Company were seen about 1885. Consummation however was deferred until the New York and New England Railroad was acquired. The Old Colony road was leased to the New Haven for 99 years March 11, 1897, all liabilities being assumed, the rental being 7 per cent a year on the capital stock. The New York, Providence and Boston Railroad Company was merged by exchange of capital stock, share for share. This was Feb. 13, 1893, and involved the two steamboat lines owned by the railroads. The New York and New

Birthplace of John Fitch, Inventor of the Steamboat

England railroad was leased for 99 years from July 1, 1898, the New Haven road assuming all obligations of the former company and guaranteeing dividends of 3 per cent per annum on preferred stock of the company. This deal included the New York and New London Steamboat Company.

Owing to legislation by Congress the New York, New Haven and Hartford Railroad Company segregated its interests in the water lines previously owned and operated by the New England Navigation Company and sold the physical properties to the New England Steamship Company. This was July 1, 1912. The consideration was capital stock and mortgage bonds of the purchasing company. The New England Steamship Company thus became operators of several lines running out of Connecticut ports.

There are no regular passenger steamboats from Norwich nor from any point on the river above New London. The coastwise receipts of freight from all vessels landing above New London in 1922 agregrated 285,489 tons having a value of $10,857,771—mostly coal, gasoline and package freight. The coastwise shipments aggregated 10,466 tons with a value of $6,822,955, package freight being the chief article classified as general merchandise. Of the carriers 23 were steamers making 2,000 trips with the greatest individual capacity of 1,224 tons. Eighty-six with 334 trips were barges, the greatest capacity being 888 tons; schooners 8 making 16 trips and the largest having a tonnage of 607; and 10 towboats the largest of 60 tons.

On the Connecticut River above Hartford nothing is doing in water transportation, navigation being limited to pleasure boats and two small steamers operating near

Springfield in the pool above the Enfield dam. On the Connecticut below Hartford which includes Hartford itself the water traffic in 1922 totaled 371,085 tons of a value of $56,613,605. All of this was coastwise, the receipts being for the most part general package freight, gasoline, iron manufactures and coal, aggregating 347,-485 tons of a value of $30,477,055 and the shipments—mostly miscellaneous steamboat freight, iron manufactures and tobacco—23,600 tons having a value of $26,-136,550. The steamers numbered 18, making 80 arrivals and departures, the greatest tonnage being 1,012; 98 barges with 596 arrivals and departures, the greatest tonnage being 265; and 12 towboats, the largest having a capacity of 154 tons.

The port of New Haven has had a recent important acquisition to the fleets that put in there. A prominent maker of automobiles is running two large steamers into not only New Haven but Bridgeport and other Sound places when necessary and into Rhode Island as well carrying machines from the assemblying plants in New Jersey. The receipts at the port of New Haven during 1923 from all points and in all kinds of craft is reported by the harbor master to have aggregated as follows: Coal, 1,350,000 tons; Lumber, 10,000,000 feet; Cement, 5,000 tons; Oil, 10,000,000 gallons; Fertilizer, 15,000 tons; Sand and Clay, 20,000 tons; Paper pulp, 10,000 tons; Plaster, 20,000 tons; Acid (to be used in Chemicals and Fertilizers,) 10,000 tons. This freight was mostly coastwise and brought in in sea and inland barges towed by tugs, some of these tow boats burning oil and naphtha. In addition the two steamboat lines brought in about 160,000 tons of freight of various kinds, mostly package.

There were 30 steamers making 2,172 trips credited

to the traffic in Bridgeport harbor. The greatest steamer tonnage was 1,160. Schooners numbered 35 with 110 trips, the greatest tonnage being 607; and barges 200, with 1,238 trips and a largest tonnage capacity of 888. The imports were solely of wood and paper—6,188 tons and a value of $81,143. Of the classified domestic coastwise receipts automobiles totaled $3,550,000, followed by ores, metals and manufactures of metals, $2,877,671. The coastwise shipments were 68,339 tons valued at $26,302,773, the greatest of these being automobiles—$3,550,000. Oysters shipped were valued at $268,683 and ores, metals and manufactures of metals at $1,889,932. All the coal for the Housatonic River passed through Bridgeport harbor, which is also used by a large number of oyster and tow boats.

No sketch of transportation in Connecticut would be complete without a statement concerning the claims of John Fitch of Windsor, Conn. to be the inventor of the steamboat, notwithstanding the success of Fulton in getting his boat on the market through a combination of fortunate circumstances. The inscription on Fitch's bronze portrait and bas relief in the State Capitol at Hartford sets forth the fact with sufficient clarity: "This tablet, erected by the State of Connecticut, commemorates the genius, patience and perseverance of John Fitch, a native of the town of Windsor, the first to apply steam successfully to the propulsion of vessels through water."

Canals

Stage coaches, packets and steamboats were the only general means of transportation in 1822 when 260 miles of the Erie Canal were finished and boats were to run

regularly that season. Everybody was excited over this new method of intercommunication. Connecticut also it was urged should have a canal and arrogate to itself the commerce of the New England states from Canada down and make connection with the Erie Canal as well. It looked like a good scheme to aid the development of the country and make a little money. The excitement even affected the Connecticut legislature which enacted a law exempting all canal stock from taxation—"Provide however, that whenever and so long as the annual net income of such corporations shall exceed 12 per cent on their capital stock, one-fifth part of such excess over 6 per cent shall annually be paid by such corporations to the treasurer of the state for the use of the state."

Canal building was undertaken by most of the states between 1815 and 1850 usually with deplorable results as in Connecticut. This was due in a measure to lack of experience, engineers underestimating the cost and over-estimating the traffic and revenues. Many canals also were planned in places where the railroad just emerging into practical operation provided better service at less capital.

The only canal in Connecticut that appears to have come into extensive operation was that from New Haven to Northampton, Mass., a distance of 78 miles to compete with the traffic on the Connecticut River. It was built not only by private subscriptions but by tolls from banks desiring charters and from cities. When it was opened it was never found sufficiently busy even to pay expenses and after a few years of arduous conflict was succeeded by the New Haven and Northampton Railroad Company. In 1840 the city of New Haven voted an annual appropriation of $3,000 for a period

not to exceed 30 years. The competition between the canal and railroad promoters was settled when the New Haven and Hartford Railroad Company extended its tracks in the direction of the Northampton canal and entered into a traffic agreement with the Connecticut River Steamboat Company. Then came the Northampton Railroad Company. Navigation was not wholly suspended however until the railroad was ready. The towpath was used for the roadbed in some places and the berm bank also; sometimes the very bed itself as even now seen, going through New Haven. Only portions could have been operated up to 1848,—the upper portions—near Farmington and above. The net loss on the canal project is figured at $1,089,425.

There are still remnants of the canal ditches and basins visible along the old route. Ruins of the canal aqueduct crossing the Farmington River testify to the grandeur of the structure, as the remains of ancient Rome mirror its former splendor. The Canal Basin and wharf are in New Haven harbor. What is now called the Viaduct extending from Chapel Street in New Haven to Water Street just above State Street is where the canal had its way in the busy part of the city. Here stood one of the landing places reached by three steps down for passengers; and here afterwards was built the old Railroad depot which with its clock was the "cynosure of all eyes." The subterranean way for the trains was probably the first of the underground constructions in this part of the country—laughed at and despised then, but now esteemed the very best for traffic.

June 20, 1828, the first canal boat at Farmington was launched and sailed. There were bell-ringing, cannon firing and music. Some 200 ladies and gentleman fur-

nished with tickets "sailed" to and over the aqueduct and back. This aqueduct over the Farmington River was 280 feet long supported by piers 36 feet in height. The boats were drawn at first by four and then by three large grey horses handsomely decorated and ridden by as many black boys dressed in white. The boat was named "James Hillhouse" after the superintendent of the company. Crackers and cheese with lemonade and wine were provided and bands played.

The New Haven Register September 20, 1828 announced that "The Farmington Canal is navigable from this city to the feeder at Eight Mile River in Southington above Barn's mills. Three boats have passed up this week with lumber for the Presbyterian church, building in Southington, and with various articles of merchandise. One boat has returned, laden with wood and country produce. Contractors have engaged to effect a complete repair in one month of the damage done to the canal at Farmington by the late freshet. As several days of the contract have already expired confident hopes are entertained that water will be let into the canal again, and boats pass up to Farmington by the latter part of October."

September 18, 1828, the "Oliver Wolcott" arrived at New Haven from Cheshire being the first passenger boat to do this. The first excursion boat was the "New England" which left New Haven for Southampton the fare being 50 cents. An interesting event was the excursion from Hillhouse Basin in the Hillhouse woods to Red Tavern, three miles out. This was on Thanksgiving day, Nov. 29, 1828. The fare was 37½ cents for adults and 12½ cents for children. "Plenty of fun." It was a nota bene however that the excursion would be

undertaken for passengers if a sufficient number offered to make it an inducement.

The "New England" was one of the best canal boats of its day. It was launched April 5, 1828, and was built with berths that swung on hinges, like those afterwards used on the Pullman railroad sleepers. These berths could be raised and put out of the way in the daytime. Her first excursion Sept. 20, 1828 must have been a success, for a similar trip was advertised for the following week.

The canal company was in continuous difficulties. The farmers were discontented with the way the land damages were adjusted and then unpaid; somebody was continuously breaking the banks, adding to the damage done by freshets. The different towns used the waters of the canal for fire purposes and New Haven, indeed, paid for this privilege. Always coming to the aid of the canal New Haven in 1829 took $100,000 of the stock and again in 1839 offered $100,000 aid, but gave only $20,000, and thereafter $3,000 a year for the use of the canal water and power, a city mill being run by it. The loans of the New Haven Bank to the canal company up to 1833 were $40,000 and it offered to take sixty-five cents on the dollar but without success; and later twenty-five cents with no takers. In 1831 the City Bank of New Haven in order to get a charter from the state had to subscribe for $100,000 of canal stock, the non-tax clause being in part payment, but as the bank afterwards became a national bank it did not long escape taxation.

But the Mechanics Bank of New Haven chartered in 1824 on condition of subscribing for $200,000 of stock became free from all taxation and has enjoyed such

non-tax privilege for over 100 years, having remained all this time a State bank.

The tolls paid by the boats running on the canal barely paid the ordinary expenses. A heavy debt and extensive damages to the canal in 1836 compelled resort to new methods of relief. The New Haven and Northampton Company was incorporated as the successor of the Farmington Canal Company with a net capital of $120,-184. This was June 22, 1836. December 3, 1838 the Hartford and New Haven Railroad was opened from New Haven to Meriden; it required only 57 minutes to cover the 18 miles. The Farmington canal did not cease its work at once; boats were plying the whole distance when possible until 1845—and later in some parts. In 1845 a heavy drought, followed by a serious break in the embankment ended all advances of money.

In 1848 the Northampton Railroad was opened from New Haven to Plainville. Relinquished debts of the canal company were paid for in stock at par of the New Haven and Northampton Company, which finally built the railroad, the Hampshire and Hampden Canal Company also being merged with the new company.

In 1819 there was what was called a natural canal running from the Housatonic River into the Bridgeport harbor. It was said to have been very useful and that with a little expense it might have been made of vast importance as it would have afforded inland boat navigation from Bridgeport to Derby. This probably explains why in 1822 the Housatonic canal project was incorporated. Nothing further was done and the charter expired by its own limitations.

The Quinebaug canal was incorporated in 1824 and the Saugatuck and New Milford canal in 1829, but these

likewise went by default. The Saugatuck and New Milford canal was run through Green's Farms, Weston, Redding, Danbury and Brookfield. The Sharon canal was incorporated in 1826 but that charter likewise expired by its own limitations.

At one time there was considerable agitation for a canal from Derby to Ansonia, and possibly further up the Naugatuck River but no work was undertaken. Mr. C. B. Burr of Ansonia states that Mr. Henry Spencer of Derby, who is reputed the best authority on the old town, told him that when he was a boy there was a short canal beginning near the old stone warehouse which was just below the railroad bridge from the Naugatuck River and extended in a northerly direction to the foot of Caroline street in Derby. It was large enough to be used by small steamboats. At that time the Housatonic was subject to ice freshets which brought down a good deal of silt and gravel and it was therefore impossible to keep the canal open. Its use was discontinued probably in the early fifties.

Steam Railways

It appears impossible of belief that in 1830 there were only 48 miles of railways in the United States and a few short line steamboats. Even as late as 1840–1850 a traveller in winter on his way to Albany from New York City would go by boat to New Haven and by rail to Hartford, thence to Springfield by stage, changing there again for the railway to Greenbush, (now Rensselaer) New York, ferrying across the Hudson to Albany. Or if he wanted to diversify travel he would take the boat to Bridgeport, proceeding to Greenbush by the Housatonic Railroad. The cars in which the traveller rode were

like omnibuses with crosswise seats and narrow corridors in the center, the stove in winter being in the center. There were separate coaches for men and women. Going to Boston the traveller went by boat to New Haven or Providence—sometimes to Stonington—and the rest of the way by rail. 1840-1850 was known as the "Railroad Era," the mileage in New England rising to 426½.

The railway did not come into existence without much opposition. The rich land owner thought the rail would destroy his fields; the stage coach and turnpike companies saw the destruction of their activities, and the canal proprietors were jealous of the trespasser. All combined to antagonize the new comer. The following is a copy of a memorial presented to the Connecticut legislature in 1832:

Your memoralists to their very great surprise have lately been informed that a petition is now pending before your honorable body, which has been referred to a joint committee of both houses, for the incorporation of a railroad from Hartford to New Haven. However beneficial in general such improvement may be it is very certain that they may be adopted under such circumstances as to produce more harm than good, and may result in great injury and injustice to private property. A railroad is a monopoly in a peculiar sense. On a canal or turnpike every one has a perfect right to use his own vehicles—not so on a railroad. The carriages upon that must belong to the proprietors of the road, or run by their special permission and must be subject to one superintendence. In the monopoly now contemplated your memorialists are informed and believe that, although no names appear on petition but those of the citizens of this state, yet a great majority of the interest is to be owned and held by strangers, citizens of other states, proprietors in the great and overwhelming establishments of steamboats and railroads which now monopolize the conveyance of passengers between the cities of New York and Philadelphia, and are endeavoring to seize the exclusive route through this state and Long Island Sound, and unite the whole

with such additions as they may hereafter acquire under one power. Should they, by the aid of legislative grants and immense and increasing wealth, extend into Massachusetts and reach the capital of New England the traveller who would enjoy the advantages of a conveyance between Boston and Washington must submit to such terms as they please to subscribe. No line of steamboats not connected with that company could partake of the right of conveying passengers on these long and frequent routes. A passenger entered at Boston or Hartford for Philadelphia or Washington would pay his fare at the commencement of his journey and be lost to every intermediate conveyance. Thus all competition would be put down and the great sums now invested by and extensively divided among our citizens, tending to cheapness and convenience as well as to equality of rights and privileges, would be annihilated, and the expense of travelling would depend upon the will and pleasure of that united interest which would find its advantage in the highest possible rates of fare.

By the grant now contemplated, four turnpike companies between New Haven and Hartford in which many widows, orphans and persons in moderate circumstances have invested their property, the steam navigation between Hartford and New York, the steamboats between the latter city and New Haven, and many other of the vested interests of our citizens would be utterly destroyed.

This memorial which has had its counterpart in years not so long ago was signed by the following famous men: Simeon Baldwin, J. Wood, Roger M. Sherman, Wm. Bristol, and Epaphroditus Champion, "overseers of turnpike stock." "All of the memorialists had investments in some of these establishments and they humbly prayed in behalf of themselves and others in like circumstances that the prayer might not be granted. The urge of the railroad however was too strong and the charter went through."

The first railroad to be opened and operated in Connecticut was the Stonington road which was a part of the New York, Providence and Boston. This was

November 10, 1837. Although the extent of the line in this state was less than five miles it was an important acquisition to the means of travel. Not so much importance was stressed on completing the line to New York as upon the importance of the steamboat connection for the metropolis and the final connection by ferry with the Long Island road. The next railroad to be opened was the Hartford to New Haven in December, 1838 to Meriden, and in 1839 to Hartford. Then came the Norwich and Worcester to Norwich in 1840; then the Housatonic in 1842; followed by the Northampton in part in January 1848 and the New York and New Haven in December of the same year; the Hartford, Providence and Fishkill, which has had so many developments under so many different names, in 1849 in part, the Naugatuck in the same year, the New Haven and New London and the Norwalk and Danbury in 1852; the Air Line in 1870 and the Connecticut Valley, the Connecticut Western and the New Haven and Derby in 1871. The various roads here enumerated have had such a variety of transformations that it is difficult to trace the mutations. There were other and smaller branch lines built from year to year but it may be said in a general way that the era of steam railroad building in Connecticut ceased in 1871.

In 1832 Connecticut incorporated the New York and Stonington Railroad Company. Nothing was done until its consolidation with the New York, Providence and Boston Railroad Company in 1833. November 10, 1837 this road was opened from Providence to Stonington, connection being made there with steamers for New York. The opening of the road as usual in those early

days was made the object of much rejoicing not only over the great speed attained in travelling but in the avoidance of the terrible seas encountered in rounding Point Judith. The distance from Providence to Stonington is forty-seven and one-half miles and it was covered on the opening day in two hours and twenty-five minutes, "which," says the Providence Journal of Monday, November 10, 1837, cited in Henry R. Palmer's History of Stonington, just published, "considering the newness of the road, the little trial that had been made of the engines, &c., &c., was remarkably expeditious." There was a big supper that night at the hotel "Waddawannuck," after the Indian "appellation" of the town and built by the road. At this supper there is said to have been 400 persons, including the Governor of Connecticut and the mayor of Providence. Of course the president of the road was there and many of the leading stockholders and money-backers of New York City and Philadelphia. They had arrived the morning of the celebration "on board the splendid steamer Narragansett," being received with a salute of cannon. After breakfast they left Providence in two trains of "superb cars, handsomely decorated with miniature American flags, the band playing many spirit-stirring airs, and by means of the Locomotives Stonington and Little Rest, they sped rapidly over the course on their way to Providence." The party returned the same afternoon to Stonington where the supper was served, turkey and partridge being the chief dishes and champagne the chief drink. There were several editors present and at the close of the festivities one of them took the trip to New York on the Narragansett with the returning capitalists.

The Long Island Railroad connection has long been a fact—from New London—and exists today but not as a rule for through travel to New York. An improved ferry boat takes many passengers and automobiles from and to Connecticut, crossing the Sound.

The Hartford and New Haven Railroad was incorporated in 1833. It was opened from New Haven to Meriden, a distance of eighteen miles in 1838 and to Hartford the year following. Through passengers were carried to Springfield by stage coaches to connect with the trains for Boston. In 1835 a line from Hartford to the Massachusetts line was authorized and built. Massachusetts chartered a road to connect with this and the through route to Springfield from New Haven was opened in 1844. The companies were consolidated in 1847 as the Hartford and New Haven Railroad Company. The southern terminus of the road was at Belle Dock, New Haven, where connection was made with New York and other places by steamboat. This was for some time a cause of jealousy between roads and led to all sorts of arrangements and payments and finally to consolidations.

The American Railroad Journal and Mechanics' Magazine for January 1, 1839, has this to say of the opening of the road to Meriden:

> New Haven and Hartford Railroad—We understand that this road is now in successful operation as far as Meriden, 18 miles, and it is intended to be finished to Hartford by the first of November next. The route from Hartford to Springfield is now under examination, a distance of 25 miles, making a direct line of railroad from Boston to New Haven.

The final backers of the Northampton Canal Company were quickly wise to the great change in methods

of transportation. The Northampton Company that was organized to straighten out the finances of the canal was at once changed legislatively so as to be able to build a railroad, and this was before the New York and New Haven railroad was completed. The Northampton road was opened to Plainville from New Haven in 1847 which was about a year before the New York road began its activities. The Northampton charter provided that so far as possible the road should be built on the tow path or on the berm bank, or if not possible, then by widening or shifting from them entirely. Even prior to its complete construction to Westfield two leases were executed, both of them to the New York and New Haven. One of these leases executed January 11, 1848 covered the road from Grand Street, New Haven, to Plainville, a distance of about 27 miles, including rights from Grand Street to the canal basin on the harbor, for twenty-one years from the date the road was completed and turned over. The date of the turn-over was fixed as July 1, 1848, but actual possession was not taken until July 1, 1849. The second lease executed March, 1848, was a perpetual one from April 1 of that year. It covered the bed of the canal from Grand Street to the Basin at the head of the Long Wharf, New Haven, with land for a station at Chapel Street, and for engine house, machine shops, &c., at the head of the Canal basin. Over the bed of the canal covered by this lease the New Haven railroad was built. By a further agreement made February 16, 1850 the two railroads arranged for the construction of a dock at the Canal basin. This was for a long time known as the Canal wharf, and freight was loaded and unloaded on and from steamers, and vessels with sails.

When the New York and New Haven was partly opened the leases were made immediately effective in that through trains were run from Plainville to Bridgeport. A notice in the New Haven Palladium of October 27, 1848 sets forth that "The 11 a. m. train from Plainville will connect with the New Haven Steam boat by a free carriage to the Boat, and the 1 p. m. train from New Haven will arrive at Bridgeport in ample time for the 2 o'clock boat from that place to New York. The 10 a. m. train from Bridgeport will connect with the 11:20 express train for Hartford, Springfield and Boston by a free carriage connecting the two roads. Passenger trains will leave New Haven from the depot in Chapel street. Freight for Bridgeport and intermediate places will be received at the Freight House on the wharf, and freight for Plainville and intermediate places at Temple street as usual. At Cheshire stages from Litchfield, Wolcottville and Waterbury connect with the down train at 11:25 a. m., returning upon the arrival of the up train at 1:05 p. m. At Plainville stages from Bristol connect with the morning train for New Haven at 7 a. m. Returning at 5 p. m. Also from Litchfield, Plymouth, Winsted, New Hartford, Collinsville, Unionville and Farmington to connect with the 11 a. m. train to New Haven—returning upon the arrival of the train at about 1:30 p. m." It was also announced that "The 3 p. m. train from New Haven and the 7 a. m. train from Plainville will be freight trains with passenger car attached. Also freight will be taken on the 8:45 a. m. train from New Haven to Bridgeport, and the 4 p. m. train from Bridgeport to New Haven." These were the winter arrangements. No trains were at that time

run on Sundays. Some years later permission was obtained from the Legislature for the operation of a limited Sunday schedule for certain freight and necessary passenger cars. All this announcement was signed "Henry Farnam, Supt."

While the middle and western Connecticut cities and towns were struggling with the several railroad projects the eastern part of the state was alive also to its importance as a part of the great transportation problem. The Norwich and Worcester Railroad Company was chartered in 1833 and in 1836 was permitted to unite with the Boston, Norwich and New London Railroad Company. The proposition was to build a railroad to connect New London and Norwich with Worcester, Mass. This union of railroad corporations is said to have been the first to be permitted in New England. The railroad from Norwich to Worcester was completed early in 1840. The line from Norwich to New London was built by the New London railroad a little later. This road was chartered in 1847 and opened in 1850. The rails paralleled the Thames River to Norwich and then went to Willimantic and Palmer, Mass., where it joined the very active Western Road. This railroad was one of the earliest to get help from a city. New London guaranteed its bonds but no interest or dividends were ever paid. The Norwich and Worcester had a valuable maritime connection at Allyn's Point to which it extended its rails in 1843.

The Manchester Railroad Company was incorporated June 4, 1833, to construct a railroad from Hartford through East Hartford and Manchester, the main object being to reach the quarries at Bolton. No organization was effected and June 23, 1847 the Hartford and Provi-

dence Railroad was incorporated. This was for the purpose of constructing a railroad from Hartford to Willimantic. An organization was effected March 7, 1848. This company was consolidated with the Hartford and New Haven taking the name of the Hartford, Providence and Fishkill Railroad Company. The line from Willimantic to Hartford was opened for travel December 11, 1849.

One of the earliest railroads in the field following the Hartford and New Haven was the Housatonic chartered in 1836 and beginning traffic operation in 1840 over that portion of its line from Bridgeport to New Milford, a distance of about 35 miles. From New Milford to the state line of Massachusetts, about 38.9 miles, the opening was December 1, 1842. The Berkshire road was leased January 11, 1843 and later the Stockbridge and Pittsfield, the Housatonic paying 7% of the cost of these roads, which was an annual rental of $74,407. The Housatonic had a steamboat connection at Bridgeport for New York, which was of much value and at once created trouble between rival roads as these came into the field. The city of Bridgeport lent the road $300,000 and in 1843 the road being unable to pay assigned its interests to the city, but even the city could not pay the interest on the money it had borrowed to loan the road and the creditors had to step in to protect themselves.

Two other roads which had an effect upon future developments because connecting with important points touched by the New York and New Haven are the Naugatuck, which was chartered in 1845 and the Danbury and Norwalk chartered in 1849. The former came into

operation in 1849, shortly after the busy advent of the New Haven, connecting with the through line at Naugatuck Junction and afterwards by traffic arrangement with the New Haven with Bridgeport; and the latter in 1852 connecting with the New Haven at Norwalk. The Naugatuck road became an important fiduciary proposition and furnished the New Haven later with some of its most efficient officers. At Waterbury, its northern limit, it "accommodates"—as an early announcement was worded—the Hartford, Providence and Fishkill. At that city as it was also stated "suitable connections will doubtless soon be made; also connects with New York and New Haven at Bridgeport and at the junction in Stratford." It was also announced as an inducement for travellers: "Waterbury car ventilators used, which adds much to the comfort of passengers during the hot and dusty season." The Danbury and Norwalk did not get into operation until 1852.

The New York and New Haven railroad was chartered in 1844. Construction was begun in September, 1847 and trains began running over a portion of the road—that from Mill River Junction in New Haven to Williams' Bridge, N. Y., about 62 miles—December 27, 1848. Two months previously, however, trains had been dispatched between New Haven and Bridgeport. The New Haven Palladium of October 27 observed editorially (there was no other mention of this important event): "The opening of the railroad between this city and Bridgeport yesterday gave an opportunity to a large number of our citizens to attend the convention at the latter place. Two trains of cars passed each way between the two cities—and probably not less than a thou-

sand persons were carried over the road. Every possible accommodation was rendered by the gentlemanly superintendent of the road, and the passengers generally expressed their satisfaction with the ride." The month previous to this—September—the Bridgeport Chronicle stated that the road was completed from the Housatonic River at Milford to Southport, a distance of about eleven miles. "Judging of the whole line of this Railroad by the part which is now completed, and which we have carefully examined, we have no hesitation in pronouncing it *first rate;* and the bridge across the Housatonic River at Milford is one of the finest specimens of masterly workmanship in this country, being 1293 feet in length, stretched upon seven piers of the most substantial masonry, making the spans each 150 feet long with a draw near the middle 134 feet in length, so excellently fitted and balanced that a mere boy of twelve or fourteen years of age can swing it open with perfect ease. On Tuesday afternoon last a party of some 200 ladies and gentlemen of Bridgeport by invitation made an excursion over the completed portion of the road. The cars glided along over the rails with so little jar that one was scarcely sensible they were in motion, when in fact they were tearing along at a speed of 45 miles per hour."

The Springfield Republican was eager to have at least two trains a day between Springfield and New York, and The New Haven Palladium December 28, the day following the opening to Williams' Bridge and thence into New York City, stated that "The directors of the Road will undoubtedly make their arrangements so as to best accommodate the public and increase their own revenues. There is no probability that they would think

of having less than two trains a day from New York." And with true editorial fatherliness it continued: "The line, if civil and accommodating conductors are connected with it, and we presume that no others will be employed, will be a very popular and a very profitable one." The cars, it was further stated, had already been very near New York "and in a few days they will roll down into the neighborhood of Canal street." Before the paper went to press the editor had received more news, for he added a postscript: "Since the above was put in type we learn that a train of cars passed over the entire road yesterday, and that the arrangements for regular trains are now complete, a train having left at 1 p. m. today to go through to New York. After today there will be two trains daily, one leaving this city at 9 o'clock a. m. and the other at 1 p. m."

Under a contract with the New York and Harlem River Railroad Company the New York and New Haven operated its trains to Canal Street about 14 miles from Williams' Bridge, leasing and buying land and buildings for offices and terminal purposes. Its cars were hauled by horses of the Harlem Road from 42nd Street to Canal Street. The terminal remained at Canal Street until July 15, 1857, when it was moved to 27th Street and Fourth Avenue, the terminal at that point being abandoned December 1872 and fixed, as at present, at 42d Street.

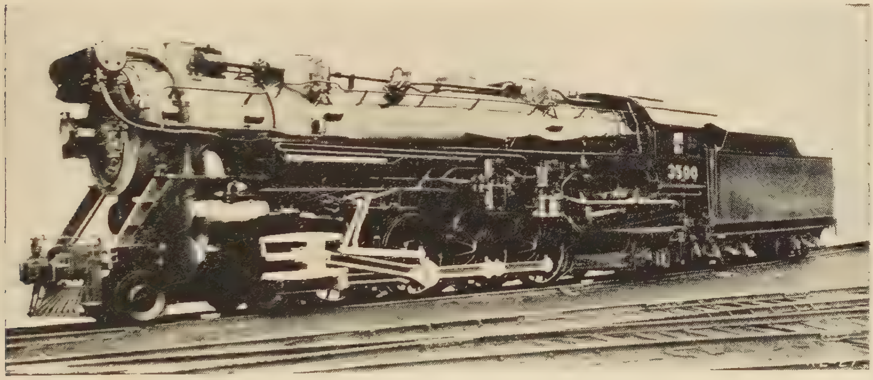
December 28, 1848, in order to obtain a share of the business of the Housatonic railroad that went to and from New York by a connecting boat line at Bridgeport, the New Haven railroad made a contract with George L. Schuyler, by which the boats were to charge the same

rates to New York and to Bridgeport as the railroad. This contract was to last till November 14, 1850. A common fund was made of the Bridgeport business the railroad receiving 55 per cent of the receipts and the steamboat 45 per cent.

Arrangements were also made at New Haven to check the competition between rail and water. An agreement between the New York and New Haven and the Hartford and New Haven railroads was made April 30, 1849, extending until July 1, 1869, by which the Hartford road ran all its trains, with the exception of the night boat train, to the Chapel street station of the New York and New Haven road, discontinuing its connection with the day line of steamers. The New York and New Haven road under this contract paid $10,000 a year to the Hartford road and $10,000 to the Connecticut River Steamboat Company which operated the boats. A further contract was made March 16, 1850, but annulled by the courts shortly after, to the effect that the Hartford road would operate no boats, directly or indirectly, to New York, in connection with the railroad unless it was a line of propellers to protect its own interests and then under conditions mutually agreed to. All of the trains of the Hartford road were to be run into the Chapel street depot. The fee for the use of the depot and for whatever else there was in the contract for the benefit of the Hartford road was $1,000 a month. The contract also provided that there was to be no extension of the Canal road, of which the New York road held a lease, north of Granby in any direction east of the old canal, in order to protect the natural business of the Hartford road.

TYPES OF LOCOMOTIVES

Roger's Celebrated "Madison" of the New Haven, New London & Stonington R. R. A Fine Type of the Late '50s.



Modern Locomotive of N. Y. N. H. & H. R. R.

Electric Locomotive

The State brought suit to compel the Hartford road to run its train to Steamboat wharf, in accordance with the provisions of its charter. The Supreme Court held the contract between the railroad companies void as against public policy and issued a mandamus compelling the resumption of the train connection with the boat.

An effort had been made some years before this to get a connection by a Shore Line road with New London, Providence and Boston. A company was incorporated in 1841 to build from Norwich to Lyme—that is, from Norwich to the Connecticut River, but only surveys were made. In 1852 the Norwich and Westbrook Railroad Company was incorporated for the same purpose but by a different route, although with like result. June 29, 1852 the New London and Stonington Railroad Company was incorporated to build from the New York, Providence and Boston railroad at Stonington, to Groton, on the east side of the Thames River, opposite New London, and to construct and operate a ferry between Groton and New London. A few years before this—in 1848—the New Haven and New London Railroad Company had been incorporated. This road was opened July 22, 1852. Six months previously the New York and New Haven with considerable foresight had accommodated the new road with landing privileges at New Haven, leasing to it land for a track from Mill River street, New Haven, to Grand street with trackage rights from Grand street to Chapel, and use of station facilities from December 30, 1851 to July 1, 1869. The New Haven and New London merged with the New London and Stonington March 6, 1857. As late as 1869 the trains between New Haven and New London crossed the Connecticut River at Saybrook on a steam

ferry boat. Under the authority of the legislature, extended in 1868, and the permission of the United States Government in 1869, the Connecticut River Bridge was built, trains passing over it in 1870. The ferry at New London, however, was continued until 1889 at which time a bridge was built from Poqonnock Junction to Groton. This formed another through rail connection with Boston. A ferry is still operated for foot and vehicle passengers.

The financial history of the New London road is full of unpaid indebtedness. Finally in March, 1862 trustees under a first mortgage of $450,000 took possession of that part of the road from New London to New Haven, the title becoming absolute in 1865. The bondholders were incorporated in 1864 as The Shore Line Railway and came into possession of the property June 14, 1865. For the railroad from Groton to New London, including the ferry, the mortgage trustees were incorporated as the New London and Stonington Railroad Company and they sold the bonds to the New York, Providence and Boston Railroad Company. In 1870—October 19—the Shore Line was leased in perpetuity to the New York, New Haven and Hartford Railroad Company.

The Middletown branch road running to Berlin, where it connected with trains for Hartford and New Haven, was chartered in 1847 and began transportation in 1851. It was owned by the Hartford and New Haven railroad. But the next great undertaking outlined was that of the New York and Boston Railroad Company which was to build from New Haven to Middletown, thence to Willimantic and then to the state line towards Boston. It was on the very day that the New

Haven road was opened that a newspaper appeal was made for subscriptions to the capital stock, the charter having been secured in 1846. The road was not completed within the time prescribed by the charter and amendments, so that all rights in Connecticut were lost and the company was merged January 4, 1865 with the Boston, Hartford and Erie, which was a predecessor of the New England railroad. Portions of the road bed were used for the construction of the New Haven, Middletown and Willimantic road which was one of the links in the chain that finally became the Boston and New York Air Line. Financial difficulties hedged the road about so that it was delayed from year to year. Supplies at times were furnished only on the personal credit of the superintendent. The road was at last opened in August, 1870 from New Haven to Middletown, and August 13, 1873 to Willimantic, the branch from Amston to Colchester being delayed until August 3, 1877. One of the beauty spots on the road is Lyman's Viaduct near East Hampton, twelve hundred feet long and thirty-seven feet high.

An almost interminable mass of coordination was the railroad that began with the incorporation of the Hartford and Providence Company June 23, 1847 to build from Hartford to Willimantic. July, 1849 it was made a part of a new corporation—the Hartford, Providence and Fishkill. The line from Willimantic to Hartford was opened for travel December 1, 1849; Hartford to Bristol June 1, 1850; Willimantic to Providence October 2, 1854; and Bristol to Waterbury July 11, 1855, so that at that time it had a road of 122.5 miles in operation from Providence to Waterbury. Bonds of the road were held by the New England Railroad Company to which

company the Hartford, Providence and Fishkill deeded their road January 1, 1879. In 1881 the road from Waterbury to Brewster, N. Y., was completed and the same year to Fishkill. What is now known as The Central New England Railroad, owned by The New York, New Haven and Hartford, was originally The Connecticut Western, chartered June 28, 1868. During the more than fifty years of its existence it has operated under five names—Connecticut Western, Hartford and Connecticut Western, Philadelphia, Reading and New England, Central New England and Western, and at present as The Central New England. Before the road was built Hartford outbid Springfield for the eastern terminal, subscribing for a half million of the stock. Ground was broken at Winsted October 20, 1869 and the last spike was driven at Canton, December 7, 1871. Four days later the first regular passenger train left Hartford for Millerton, N. Y., then the terminus of the road. In 1868 the road secured a terminal at Rhinebeck on the Hudson by purchasing the Rhinebeck and Connecticut railroad and in 1888 the building of the great bridge over the Hudson was outlined. This was not opened for traffic until 1892, at which time only one bridge was larger, that over the Frith of Forth in Scotland. It is interesting to note that among the engines pulling trains over this road were the "City of Hartford," "Falls Village," "State Line," "Salisbury," "Norfolk," "Winsted," and "Bloomfield."

Hartford had long wanted a connection by rail with Saybrook and the intervening river towns, which were reached only by boat and stage coach, so that in 1868 a charter was secured for the Valley road from Hartford to Fenwick about forty-five miles. It was opened from

Hartford to Saybrook August 24, 1871, and from Saybrook Point to Fenwick July, 1872. The first train left Saybrook Point Saturday, July 31, 1871 at 9:30 a. m. and was made up of four passenger coaches and a baggage car.

The little Derby railroad was opened from New Haven to Derby in 1871. It had a depot in New Haven on West Water street at the foot of Meadow where there was nothing but a basin full of mud, and some water at high tide. By an arrangement with the New York and New Haven road it was able to take and receive freight from the Starin line of boats at Starin's wharf reached by crossing railroad tracks with cars drawn by horses. The location of some of the railroad property was so advantageous that when the building of a new depot was undertaken by the New York road a contract was made with the company providing for the filling in, conveyance, and occupancy of the flats southerly of Water street and easterly of Meadow street extended. Before the Derby road was opened passengers from New Haven for Derby and Ansonia had to take the New York road to Naugatuck Junction where they changed for the Naugatuck and finally reached their destination. There was a special train every morning leaving Ansonia at 7:30 a. m. and a special from New Haven at 6:30 p. m.

In 1853 the New York, Housatonic and Northern Railroad was chartered to connect with the Harlem railroad at White Plains, N. Y., and at Brookfield, Conn., with the Housatonic. The great idea was to take all the traffic from New York and the west and pass it on to New England through the Housatonic road. After the six miles from Danbury to Brookfield

had been built the scheme was abandoned in its then shape. Occasionally over these six miles a dummy engine with a single car made a trip with passengers until the Housatonic took over the mileage under a lease. The village of Ridgefield was assisted out of its stage coach days in 1870 by a connecting link with Branchville, and from Bethel in 1872 another branch was built to connect with the Shepaug, afterward known as the Shepaug, Litchfield and Northern.

The relic of a most ambitious project is the present ferry or steamboat service between Norwalk and Huntington, L. I. In 1882 the Danbury and Norwalk was extended from South Norwalk to Wilson's Point three miles to the south on Long Island Sound. Here large docks and transfer bridges were built. Before the scheme came into practical operation the Housatonic secured a lease of the Danbury and Norwalk. It was then that the ambitious project was pushed to the limit. Passenger and freight cars were loaded on transfer boats and sent into New York City and for the west and south over the Long Island Railroad from Oyster Bay. The return trains were taken to Boston and other New England points over the Housatonic and the New England. It was the intention to take business away from the New York and New Haven road. There were so many delays by storms on the Sound during the fourteen miles of ferry trip that both the passenger and freight traffic fell off and the ambition had to be abandoned. Both the Housatonic and the New England were soon after leased by the New Haven, and the Long Island and Eastern States Line as the undertaking was called—nicknamed the "Long Interval and Empty Seats Line"—became an amusing incident of the past. But

Wilson's Point continues an important coal and oil point.

One of the few railroads now owned by a separate and distinct company without other transportation affiliations is the South Manchester railroad extending from Manchester to South Manchester, a trackage of about 2.25 miles. It was incorporated May 30, 1866, completed in 1869, leased to the Hartford, Providence and Fishkill until about April 1, 1879, when it was surrendered to the South Manchester Company, owned by the Cheneys, silk manufacturers, by which it is now operated.

Another evidence of attempt to escape from a monopoly in transportation was the organization of the Meriden, Waterbury and Connecticut River Railroad June 9, 1888. It was the consolidation of the Meriden and Cromwell, organized July 10, 1882 and the Meriden and Waterbury organized May 24, 1887. The freight shippers of Meriden and Waterbury had become dissatisfied with freight rates and methods and decided to try a part rail and a part water transportation for both their raw materials and their finished products, the point of water contact being Cromwell on the Connecticut River. Nothing much was done although passengers and freight were carried to some extent. The road was finally leased to the New York and New England for ninety-nine years from September 1, 1892. It was abandoned in 1924.

The great growth of the railroads in the state is shown by a comparison of the passengers carried in 1854 and in 1923, 2,958,698 and 86,166,166. Of the passengers in 1854 the New York and New Haven carried 1,111,031, while in 1923 the great combination, the

New York, New Haven and Hartford, carried 84,721,-323, the Central Vermont reporting 941,882, the Central New England 366,172, and the South Manchester 136,789. The tons of freight transported in 1923 aggregated 41,307,558, the New Haven having 28,934,-588, the Central New England 7,843,683, the Central Vermont 4,445,890 and the South Manchester 83,397. In 1856 the railroad mileage in the state was reported as 600; in 1922 it was given as 1,000.69. In 1848 the passenger fare from New Haven to Springfield was $1.87; in 1924 it is $2.24; on the Stonington road from Providence to Stonington it was $1.50 and from Boston to New York $5. The fare from Boston to New York is now $8.23. But in all these comparisons the difference in the purchasing power of the dollar must be considered. For the fiscal year ending September, 1923, the Public Utilities Commission granted 15 petitions of steam roads to run Sunday trains, such petitions being necessary under the law passed some years ago. Most of the petitions were for transportation of soldiers, or members of fraternal orders, or dramatic and orchestral companies. Three grants were for the wholesale purpose of authorizing the operation of "trains on Sundays as shown in time table No. —" (number being given.)

The miles of steam railroad operated in Connecticut are given as 1,003.89 of which the New York, New Haven and Hartford operates 851.98. Taking the mileage of all tracks the figures are more than double these.

The number of employees of all steam roads in the state was 36,728 in 1922 and the payments to them $58,-642,520.68; of these figures 32,355 and $51,921,362.58 were reported by the New York, New Haven and Hart-

ford. The amount paid in pensions—or annuities—to retired employees in 1922 was nearly $300,000. of which the New York, New Haven and Hartford paid $281,-795.80. The New York road also employs 400 policemen to guard its stations and protect its patrons.

It is not practicable to segregate the investments and the earnings and expenses of the five operating railroads so as to give the figures for Connecticut alone, nor are the figures such as they are available for a year more recent than 1922. That year the investment in road and equipment by the five roads was $336,378,022.24; the operating revenue $137,283,544.43, of which $71,-603,915.64 was from freight. The combined profit and loss account of all companies showed a deficit of $50,-239,319.26, which deficit had been growing from year to year. For the year 1924 it is supposed that this was considerably diminished. The only operating road declaring a dividend was the Central New England which is controlled by the New York, New Haven and Hartford.

Equipment Development

During the first years of experience with the locomotive the steam railroads were in the habit of advertising that when it stormed severely the cars would be hauled by horses, much to the amusement of auto owners of the present day who say that the "precious locomotive was too delicate to be outside in stormy weather." But it must be remembered that the first locomotives consumed wood only, before the generation of steam; it was some time before coal became available or was thought a fit fuel. It was as late as 1860 that Marcus M. Rounds, superintendent of motive power of the New York and New Haven submitted a report on the

use of coal, in which he stated that he had changed six engines from wood to coal burners, the reduction in running expense being nearly thirty-three per cent, from 17.5 cents to 11.6 cents per mile. This included kindling material and was based upon experience with the same trains. But yet only a few years before, in their report of 1855-6 the railroad commissioners had stated that "Much has been written upon this subject and numberless experiments tried at a large expenditure of time and money, but thus far it does not appear that any of these coal engines have driven from the field those consuming wood. There is no doubt that coal can be consumed in ordinary locomotive boilers modified as they have been by various inventors, but the question is whether, out of the coal districts where coal is very cheap, the result both as regards the annual cost of fuel and the repeated renewal of fire box rendered necessary from the corrosive effects of sulphur which all coal contains, is a saving as compared with wood engines, and this is a question which has not yet been satisfactorily settled."

The first locomotives used on the railroad in Connecticut weighed about six tons; the weight was gradually increased until in 1854 the biggest of the freight engines was listed at forty tons. This weight is now more than double. The recent electrical engines put upon the New York and New Haven lines are also said to be double the tonnage of the first electric introduced, which was eighty tons with a tractive effect of 36,000 pounds. These mighty engines will haul a standard steel passenger train of twelve coaches at the rate of a mile a minute. On the first locomotive the engineer had no covered cab and the tender, which was loaded to the top with great logs for fuel, had no sides, being supplied with a roof to

keep off the rain and the snow. In some of the old drawings of engines and engineers the engineer stands on the ground outside the cab wearing a tall or stovepipe hat, so important was his position. In 1849 the driving wheels were under the cab. The smoke stack was usually straight but sometimes slightly bell-shaped. The smoke stack has now almost disappeared and it is prophesied that it will soon give place to a small opening somewhere else, scarcely noticeable. The New York, New Haven and Hartford Railroad a few years ago equipped all its steam engines with a device to superheat the steam, increasing the hauling capacity by 20 per cent, saving the same percentage in coal consumption and more in the use of water.

The first coach used on the first railroad in Connecticut was probably patterned after that used on the Boston and Providence in 1835 for only two years later the division from the Rhode Island state line to Stonington was opened as a part of the Boston, Providence and New York railroad. This coach was similar to a stage, with four wheels, leather springs and doors on the sides. About eight passengers were carried inside and the same on the roof. A guard sat in front and one in back. It was an improved Concord coach and was highly spoken of by travellers. Afterwards the coaches were enlarged and at length adapted to contain sixty passengers who rode much more comfortably because the curves and irregularities of the tracks were lessened in their effects by two separate trucks attached to the car bodies even as now. Some of the cars were at times heated in winter by a stove set in the middle, and doors for entrance and exit are said to have been on the side as in some street and subway cars now. In other cars there

was a stove at both ends. The passenger was very hot if he had a seat near but was very cold if in the middle. The light was by tallow candle. There were no ventilators and no screens to the very small windows with outwardly protruding small glass lights, only the center one of which could be opened. The absence of a spark arrester on the locomotive, added to the plague of dust which filled the car. The car springs were bad, the windows rattled and conversation was a luxury. The Connecticut Railroad Commissioners in their report for 1856-7 stated "that the hand of genius has swept from the roads of the country the small, inconvenient and insecure passenger carriages and placed in their stead those combining strength, utility, comfort and even luxury itself." And yet the Westinghouse air brake did not make its advent until 1869 nor the vacuum brake until 1871. It was in the sixties that the danger of stoves in the cars and of wooden cars also came to the attention of the travelling public. Stoves were prohibited by law and cars were heated with hot water through pipes running near the floor and connected with the engine boiler. Covered passageways were used on the Naugatuck road in 1857 mainly however, for ventilation so that the car windows could be kept shut and avoid the dust and cinders. Raised roofs on the cars were not introduced until about 1868, many of the old cars being changed in this way to secure ventilation. Vestibuled trains came in in 1887 and coupon tickets about the same time. Baggage checks, which are now an every day occurrence, did not appear for several years following the introduction of rail transportation. The carrying of the mails in separate compartments of the baggage car was sug-

gested in 1835 but it was not until 1862 that an attempt was made to distribute the mail en route.

For some time before the sixties the danger of wooden cars had also impressed itself upon the populace and the substitution of iron was considered worthy of immediate adoption. Steel cars did not come into extensive use in this state until the Pennsylvania road declined to allow wooden cars to be hauled through its tubes.

Sleeping cars were patented December 2, 1856. The Wagner cars were the first to be used in Connecticut. Long before the idea was patented a car with berths was run on the Cumberland Valley road in Pennsylvania; this was in the winter of 1836-7. No bedclothes were furnished; only a coarse mattress and pillow. It was in one of these painful sleepers that George M. Pullman travelled in Illinois and he decided to invent something better. He brought out one in 1857, made it better in 1859 and in 1864 perfected it. He hinged the upper berth and provided a depository for the mattresses which hitherto had been piled at the end of the car. In 1867 he formed the Pullman Car Company which, since the Wagner contract ceased, has supplied the Connecticut steam railroad companies with not only their sleeping cars but with their Pullman day coaches also. The dining cars are operated by the local roads themselves. The Pullman Company paid the New York, New Haven and Hartford Railroad Company $700 per car per annum in 1913 for hauling their cars. Some of the sleepers in 1910 were wholly of compartments with brass beds and every toilet convenience except a bath tub; electric drop lights and fans; and with rooms en suite.

In 1924 the New York, New Haven and Hartford road put on a number of newly arranged steel coaches to accommodate the increased commuters' rush to and from New York. Instead of a seating capacity of 80 they possess one of 108, thus assuring every commuter a seat. The weight of the passengers carried is reduced about one-third. Instead of a seat on each side of the aisle seating two, a seat on one side seats three and on the other two. There are no arms to the seats thus affording room in the aisle for the easy passing of two passengers.

The New York, New Haven and Hartford road also in 1924 supplemented the steam engine with an important auxiliary, that is, the gasoline car which it has placed on the route between New Haven, Derby and Botsford and on the Suffield and Windsor Locks branch, thus solving the economical problem of insufficient traffic to support operation of standard equipment. Each car provides accommodations for sixty passengers and two thousand pounds of baggage and is operated from either end like a trolley car. In addition, a smaller car carrying thirty-four passengers and with baggage and smokers' accommodations, is now operating over the Air Line.

Express Companies

The founders of the express companies were, some of them, actual deliverers of packages over the early railroads and steamboats, having learned their vocation from the stage drivers who profited by the delivery of messages, the collection of promissory notes and the delivery of money in packages. They also delivered letters and parcels some of which they carried in their

hats. As railroads were seriously injuring the stage coach business the drivers and agents whose lines had been supplanted were frequently made conductors, depot masters or freight agents. Others had free passage, improving the opportunity to carry packages and letters. The founder of Harnden's Express had to abandon his position in the Boston and Worcester ticket office in Boston early in 1839 owing to ill-health due to sixteen hours of labor a day. He advertised in a Boston paper February 13, 1839 as an express package carrier between Boston and New York and *"vice versa,"* four times a week. "He will accompany a car himself for the purpose of purchasing goods, collecting drafts, notes and bills. He will take charge of small packages and forward merchandise of all descriptions (except that prescribed by the Railroad Companies.)" Mr. Harnden alluded to an extra car of which he had charge but this was nothing more than an ordinary valise. The through line of communication between the two cities in 1839 was by rail to Providence and thence by boat to New York. He might have used the rail to Stonington, Conn., and thence by the Stonington but he evidently thought the one named was the quickest. Later, in 1843, he contracted for a crate or car by this line. Harnden's brother Adolphus was lost on the Sound in the burning of the Steamer Lexington and with him $30,000 in specie he was carrying for the Merchant's Bank of Boston. Harnden's Express not long afterwards was established in many cities not only in this country but abroad. William Webb was Harnden's agent in New Haven but before that B. Beecher, Jr. was in an express business of his own.

Then came Alvin Adams, the real manager of the

Burke express until he founded the Adams Express Company. Henry B. Plant through Webb's influence became the southern agent of the company and built up a fortune. Webb and Plant had been partners in the West India trade. It was in 1848 or thereabout that Adams & Co. sent their money packages over the New York and New Haven railroad, then just completed, paying $1,700 a month for the privilege. The express freight went by boat from New Haven but was soon afterwards changed and billeted by train also. July 1, 1854, Harnden's, Kingsly & Company's, Hoey's Charleston, and Adams & Company's expresses were consolidated under the name Adams Express Company.

During the Great War the U. S. Director-General of Railroads made an agreement with four leading express companies as a war measure under proclamation of March 29, 1918 by which they were to unite in a corporation capitalized at not to exceed $40,000,000 subscribed for at par. The object was to carry on transportation business for the Director-General. The four companies were the Adams, the American, the Southern, and Wells, Fargo & Company. They were to turn over to the Director-General all leases, contracts, and agreements relating to their express transportation business in the United States, except contracts for express privileges with railroads or systems under Federal control at the date of the agreement. The latter the companies were to cancel as soon as possible. Upon termination of Federal control each company was to receive back its property and the corporation was to be dissolved.

This dissolution never occurred and that is why we now see only the name "American Railway Express" on

the railway cars and delivery motor wagons doing our through express business. The Interstate Commerce Commission in its report for 1920 stated that "There is now pending before us an application under Section 5 of the Interstate Commerce Act requesting authorization for a continuance of the consolidation of the express companies with the American Railway Express Company. There has also been submitted to us for approval a proposed new contract to be entered into between the express company and the carriers over whose lines it operates." In its report for the year following the Commission stated the "Conclusion as reached . . . that the public interest would be promoted by the continuance of the consolidation and an order was entered approving and authorizing such consolidation. Regulations also have been made covering the form of contract between the consolidated company and the railway companies over whose lines it operates." The Public Utilities Commission of Connecticut stated in its report for 1920 that the American Railway Express Company operated over 2,287.07 miles on the New York, New Haven and Hartford railroad, 1,009.51 being in Connecticut. It pays the railroad a certain per cent of its gross earnings. In 1922 this percentage as reported to the Public Utilities Commission amounted to $3,082,609.27 which was a decrease of $2,326,999.58 from the receipts of the previous year. The receipts from the General Government for the carrying of the mails were $1,510,890.65 a decrease of $1,168,310.37 from the figures for 1921. In 1923 the express receipts had increased to $5,457,693.93 but the payments for mail carriage continued to decrease, amounting to $1,485,431.94. An application for an increase in mail pay was finally submitted to the Interstate

Commerce Commission in November 1922 and favorably acted upon December 13, 1923, the increase being approximately $512,000. per year. The express companies likewise asked for an increase in rates but the request was denied and in addition certain reductions were required.

The American Railway Express Company in 1922 paid four operating steam railroads in Connecticut $4,892,565.39 of which the New York, New Haven and Hartford received $4,679,045.99.

Electrification and Hell Gate

As far back as 1850 the Hartford and New Haven railroad began merging small roads with itself and increasing its capital stock for the purpose. Acts of this kind were repeatedly done by that company down to the consolidation of the road with the New York and New Haven under its present name of New York, New Haven and Hartford in 1872. Since that time the consolidations have been so numerous and diversified that it is almost impossible to state them. There were more than 300 subsidiary corporations of all kinds attached to the road in 1914. There are now only two independently owned steam railroads in the state—The Branford Steam Railroad Company which is used solely for the freighting of trap rock from the quarries of The New Haven Trap Rock Company, the trackage being 6.2 miles; and The South Manchester Steam Railroad Company extending 1.94 miles to Manchester.

During this time of consolidation some of the greatest advancements were made in transportation facilities, including electrification and the building of the bridge over Hell Gate, the latter being the joint work of the

New York, New Haven and Hartford and the Pennsylvania roads. In 1893 railroads in Connecticut were given the right to use electric power. The directors of the New York, New Haven and Hartford in their report to the stockholders in 1894 called attention to the construction of electric railroads throughout their territory. "Wherever they seriously reduce the revenue of this property we shall be compelled to lessen local service in a corresponding degree." Instead of doing this the road started the third-rail equipment between New Britain and Berlin in 1897 and also between Hartford and New Britain and Bristol. These were abandoned as too dangerous, although at one time the third rail was advocated to replace locomotives all the way from New York to Boston.

In 1907 the Highland division from Burnside to Vernon and from Rockville to Melrose was electrified. In 1917 an electric power house was built at Berlin, whence power was distributed in four different directions, supplying the New England division by way of New Britain, Hartford and Bristol. In 1898 the New Canaan Branch was provided with the overhead trolley.

The electrification of the line between Woodlawn and the Grand Central station was the third rail, begun in 1904 by the New York Central to comply with a new law against steam operation in Park avenue tunnel. The New Haven road had to build from Stamford to Woodlawn so as to comply with this same New York requirement for other motive power than steam for entrance into the Grand Central station. The single phase alternating current system was used, for the first time on any railroad, securing an overhead conductor of the most effective kind in connection with electric locomo-

tives thus avoiding the dangers of the third rail. This first part of the system was completed in 1907, and the remainder which extends to Cedar Hill in New Haven, in 1914. The anticipation was that the rest of the road to Hartford and Springfield and by way of the Shore Line to New London, Providence and Boston would be electrified and that only electric locomotives would be used for both passenger and freight trains, the steam engines being utilized for some parts of yard work, but financial reasons have so far prevented the realization of these ideas.

Between New York and New Haven, including all yards and sidings there are 518 miles of track equipped for electrical operation, excluding that part of the New York Central Company between Woodlawn and Grand Central Terminal. The investment in this electrification was about $20,000,000, including locomotives, electrical shops and freight yards of which the large modern hump classification yard at Cedar Hill with probably the largest layout platform in the country is said to be of a value of $8,000,000. The plant for supplying electric power for the electrical operation of the whole division is at Cos Cob, (Greenwich), Connecticut. The original works were completed in 1907 but their capacity was more than doubled in 1913 and a further enlargement was completed in 1924. The company has over 100 electric locomotives already in use for freight and passenger trains, some of them weighing 150 tons exerting a maximum tractive effort of 40,000 tons and hauling a freight train of 1,500 tons at a maximum speed of thirty-five miles an hour. These are also supplied with third-rail shoes so that they can operate over the New York Central's twelve miles of track into Grand Central, this

being a third rail. Many multiple unit cars are also used for local passenger service and classification yards.

The famous Pennsylvania railroad tunnel under the Hudson River connecting New York City with New Jersey so that a train may shoot through in five minutes without inconvenience was started April 1, 1904 and completed in 1910. To make this tunnel effective for long distance transmission it became necessary to construct the Hell Gate Arch Bridge, 3,000 feet long and 300 feet high, the longest in the world. The New York, New Haven and Hartford Railroad Company was interested in this and became joint owners with the Pennsylvania road in the New York Connecting Railroad Company which was organized to carry on the work. The Arch bridge and the bridges connecting therewith cover 15,840 feet; with the steel and concrete viaducts the distance covered from the New Haven's Harlem River branch at 142d street in the Bronx to Long Island City is ten miles. There it enters the tunnel under the East River. The cost of this structure is given as $28,000,000 of which half is an expenditure of the New Haven road. This route linking New England with the entire Atlantic seaboard was opened to traffic April 1, 1917, work having been begun in July 1912. When the old method of transmission of trains by boat from Harlem River to Jersey City was thus brought to an end, every old traveller rejoiced that the through trains were no longer several hours late. The chief necessity of the Hell Gate route was an order of the Interstate Commerce Commission forbidding the running of trains on these ferry boats owing to the great danger from fogs and collisions. It is a matter of congratulation

that no serious accident ever occurred but the danger was certainly great. After the issuance of this order the through trains for Washington and the south were sent by way of the Poughkeepsie Bridge for a while and then over the new route. There are now at least ten trains a day into the Pennsylvania station from the New Haven road. No freight trains enter the station—a few coal trains went through for the Government during the Great War—the electric freight trains of the New Haven road going west and south over the New York Connecting Railroad to Sunnyside Junction and then southeasterly to the junction at Fresh Pond where they pass over the Long Island Railroad to Bay Ridge and by car floats to the Jersey shore.

Counting yard tracks, second, third and fourth tracks and sidings, the New York, New Haven and Hartford has over 700 miles of electrified tracks. A recent announcement is that all travel and freight between New York and New Haven would hereafter be made with electric locomotives, the purchase of twelve new electric locomotives making this possible.

The Schuyler Fraud

The New York and New Haven Railroad Company was incorporated in 1844. Robert Schuyler of New York City was elected President May 19, 1846, and while holding this office was appointed Transfer Agent. He was a member of the brokerage firm of R. and G. F. Schuyler founded July 3, 1846. From that date to the time of its failure, July 3, 1854, this firm was a large holder of the railroad stock and a constant dealer therein. Schuyler resigned the day following the failure of his firm, sending to the directors of the railroad

TYPES OF STREET CARS

Early Type of Horse Car

The Van Depoele Electric Car

Modern Electric Car

a communication disclosing that he had been making and selling fraudulent issues of the railroad stock. He then fled the country and was never brought to punishment. It was found that he had issued to the firm of which he was a member 17,752 shares of New Haven stock beyond the number authorized to be issued by the charter of the road. There were a number of notable lawsuits brought, all of which were decided against the company, on the ground that Schuyler had authority to act as transfer agent and that the entire management of the transfer office was left in his hands without any examination or interference on the part of said company or its directors. All the meetings of the Board of Directors were held at his office in New York. The firm at the time of its failure held 160 shares of the genuine stock.

The Railroad Commissioners in their report for 1854 referred to the fraud as follows:

> The recent stupendous frauds of certain executive officers by which not only honest individuals were made to suffer but a general shock was given to railway interests throughout the country, in our opinion call for some legislation to secure the public against crimes of this character. The true interests of stockholders have been somewhat injured in other respects than in the sale and transfer of fraudulent stocks. The comparative cost in constructing some of the public works under equal circumstances as well as inconvenient business arrangements often indicate something more than a want of judgment.

The railroad had kept no bank account for the deposit of moneys; all received for construction account by Schuyler as President and transfer agent was deposited by him in the bank accounts of R. & G. L. Schuyler. When the railroad needed money he drew it out. After

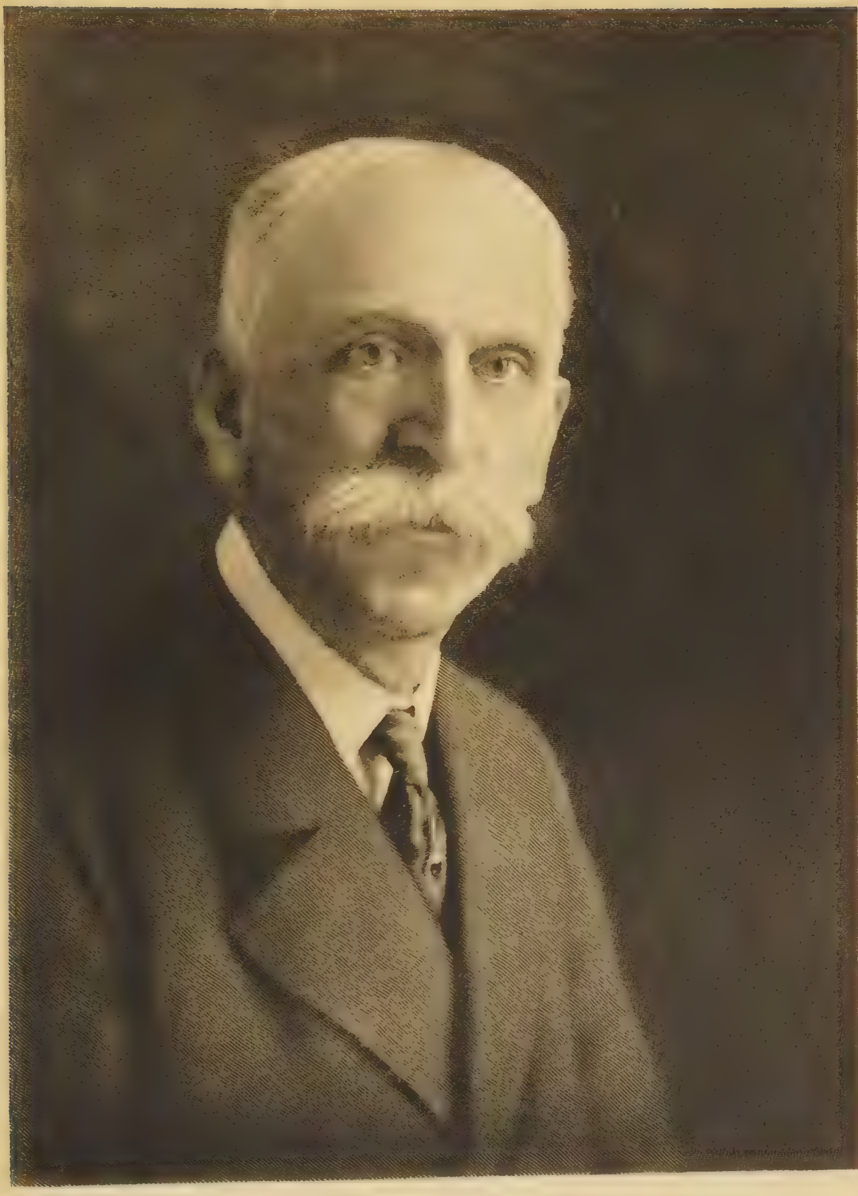
the railroad was defeated in all its suits, whether brought by it or against it, as much of the fraudulent stock as could be traced was bought up on the best terms possible, the legislature having authorized in 1864 an increase of capital stock not to exceed $2,000,000. In the statistical report to the Railroad Commissioners found in the volume for 1867 $769,395.38 is given as the amount paid to settle claims under the Schuyler Fraud, the same being in the form of an issue of stock distributed pro rata among stockholders at a price just sufficient to pay the claims, the discount from par value being charged off to profit and loss.

Sale of Subsidiaries

In response to a resolution of the United States Senate of February 3, 1914 the Interstate Commerce Commission made a detailed investigation of the financial transactions of the New Haven company since 1903. Up to 1914 the company had been esteemed one of large earning capacity with an unlimited future. The dividends from 1887 to 1893 were ten per cent per annum, the highest quotation during that period being $279 per share; during 1894 the dividend was 9 per cent and from that time to 1914, 8 per cent. No dividend has since been declared. The finding of the Interstate Commerce Commission set forth in part that the New Haven system had more than 300 subsidiary corporations in a web of entangling alliances with each other, many of which were seemingly planned, created and manipulated by lawyers "expressly retained for the purpose of concealment or deception." The Commission found that the system in 1903 showed a capitalization of $93,000,000 and that in ten years this was increased to $417,000,000. Approxi-

EZEKIEL G. STODDARD

Banker, was born at Seymour, November 14, 1844, the son of Thomas and Esther Ann (Gilbert) Stoddard. After a private school education in New Haven he entered the wholesale grocery business but before his death his business activities covered banking, insurance, manufacturing, public utilities, ranching, and mining. Mr. Stoddard took time from his many business and civic engagements to indulge in the recreations of tennis, golf and riding. He married Mary deF. Bullock in 1870. They had three children, Mrs. Frank S. Butterworth, Louis E., and Carlos F. Stoddard. He died in New Mexico, September 18, 1923. Anthony Stoddard, a direct ancestor, settled in Boston about 1639.



Ezekiel G. Stoddard

mately $120,000,000. of this was devoted to its railroad property for betterments and equipment, and $204,-000,000 for operations outside. The Commission reported that "Through the expenditure of this sum the railroad system has practically monopolized the freight and passenger traffic in five of the states of the Union. It has acquired a monopoly of competing steamboat lines and trolley systems in the section which it serves. The financial operations necessary for these acquisitions and the losses which they have entailed have been skillfully concealed by the juggling of money and securities from one subsidiary corporation to another."

In August 1914 the directors of the New Haven road, to avoid the appointment of a receiver, agreed with the United States Department of Justice to surrender control of certain railroad, steamship and trolley property, properties, representing on the companys' books more than $135,000,000. The railroad company did not assent to or dissent from, the principles of law involved, or the commercial wisdom of the proposed plan. Under the terms of the agreement the various stocks were placed in the hands of federal trustees to be sold by them, the trolley stocks within five years and the outlying steamship stocks within three. A claim was made that under the Panama Canal act the Sound Lines could be retained. This claim was allowed and the New Haven System still includes the New England Steamship Company which runs the boats from Bridgeport, New Haven and New London, and the Hartford and New York Transportation Company handling the boats between Hartford and New York. When the decree was passed it was provided that for good reasons shown the time of sale could be extended by the court. This

is why the trolleys of the Connecticut Company, all the stock of which is owned by the New Haven road, are still under the control of the trustees. These trustees were again to appear in court in April 1925 to tell why they have not sold. The New Haven System's ownership of stock in the Boston & Maine Railroad is still a continuing force; likewise its 99.9 per cent ownership of the Central New England.

The United States secured the indictment in 1914 and 1915 of certain of the directors of the New Haven road on the charge of being concerned in an illegal combination and conspiracy to monopolize interstate trade and commerce in the transportation of freight and passengers. When the case against certain of them was tried the jury disagreed. Since then a number of the others have died so that the government caused the indictments to be quashed in 1924. Now that the road is increasing its net earnings there is apparently a better outlook ahead. In July 1923 the joint New England Railroad Commission suggested the recapitalization of the New York, New Haven and Hartford Railroad by the issuance of $81,044,436 new 5% preferred stock, par $100 cumulative after July 1, 1927 and the conversion of the now outstanding stock $100 par into new common, no par, on share for share basis. New preferred was to be offered to bondholders for their bonds.

Street Railways

The horse railway entered Connecticut about the year 1860 reaching its zenith in 1888 when electricity—the trolley—was introduced in Derby only two years following its appearance in South Bend, Indiana. The interurban character of this transit, which is today such a

marked characteristic of our transportation problem, followed shortly after the opening of the present century, becoming accentuated when the New York, New Haven and Hartford Railroad Company segregated its trolley lines as the Connecticut Company in 1910, and the Plant System began its wide-spread Shore Line Electric Railway about the same time.

The Hartford and Wethersfield Horse Railroad Company was incorporated in June 18, 1859, and the Fair Haven and Westville Horse Railroad Company at the May Session, 1860, to cover the city of New Haven. In 1862 Norwalk had its first horse railroad company incorporated, followed by the Hartford and West Hartford company in 1863, and the Bridgeport in 1864. This same year the Norwich Horse Railroad Company was chartered; in 1865 the New Haven and West Haven and Centerville; and in 1866 the East Hartford and Glastonbury. Middletown did not get its horse railway until 1871; Birmingham and Ansonia in 1876; New London lingered until 1886 and Montville until 1889. There were one-man cars on some of these lines, even those in Hartford and New Haven, the passengers entering by the front doors and handing their money to the driver. Some of the Hartford cars had hard times climbing Asylum Hill.

In 1875 the legislature permitted the horse railroads to use any improved motive power. The West Haven road at New Haven tried a dummy engine but did not continue it. In 1893 the Fair Haven and Westville company was given power to operate its cars by means either of cable or of the overhead or other electric system, or any other motive power, except steam, or to make use in part of each of said systems.

It was due to the enterprise of Birmingham and Ansonia manufacturers that the trolley was introduced into Connecticut. The expense of teaming to and from the factories and the dock of the Naugatuck Steamboat Company at Derby was so large that the cost of freight by boat was no less than by rail. To cut down this hauling cost the Derby Horse Railway Company was organized in 1885, but before the construction had been proceeded with to any considerable extent, attention was called to the Van Depoele system of electrical trolley operation just installed at Scranton, Pennsylvania. A contract was made with the electrical company to furnish electrical apparatus and equipment to run three 12-foot passenger cars, carrying forty passengers each, at the rate of twelve miles an hour and at the same time to run a large motor car hauling thirty thousand pounds three miles an hour. The track and overhead were ready for operation May 1, 1888 and went into service, the first trolley line in the state. In October, 1889 the Naugatuck Steamboat Company went out of business and the freight motor was permanently retired. The passenger cars continued to operate until replaced by later types. In the early installation the road used turntables as the cars had control apparatus at only one end.

During horse car days there was little heat in the cars in winter. A stove at one end was used, with coal, to deceive the public into the belief that the chill in the air was being removed. As to the light at night that was afforded by oil lamps at either end of the car. When the snow fell so that it was difficult if not impossible to conduct transportation little attempt was made to run; in some cities long, covered sleds were substituted until the snow and ice melted. When the trolley came

in, heat and light by electricity made street car riding delightful, and the snow plow cleared the tracks.

The legislature of 1896 granted acts of incorporation to 15 new street railways.

All of the roads reporting in 1895 with two exceptions are now in possession of the Connecticut Company which since 1910 has dominated the street and interurban trolley transportation within the state. One of the lines, the West Shore is operated by the Connecticut Company under lease. The two exceptions to the inclusion are the Bristol and Plainville Tramway Company, which has earned and declared a dividend regularly ever since it made its first report to the Public Utilities Commission in 1911; and the Danbury and Bethel Street Railway Company which went into the hands of a permanent receiver in 1917. Since the date of the reports made for 1895 many new corporations were authorized to go into the business of transportation by trolley. These added to the list make a total of 59 corporations brought together under the Connecticut Company.

The independent companies operating now are the following:

Bristol and Plainville Electric Company, formerly Bristol and Plainville Tramway Company; Danbury and Bethel Street Railway Company; Hartford and Springfield Street Railway Company (in hands of a receiver); Lordship Park Association (of Bridgeport for the care of the owners and residents of Lordship Park in particular); New York and Stamford Railway Company (operating 8.591 miles in the state under lease from the New York, New Haven and Hartford Railroad Company); The Shore Line Electric Railway Company; the Waterbury and Milldale Tramway Company,

and the New Haven and Shore Line Railway Company.

There are six other street railway lines that are closely associated with the New Haven system either by ownership direct or through the ownership of companies operating them. Two others not now operating,—the Canaan and the West Thompson lines—are also owned by the company. The ninth is leased by the New Haven system from the Norwich and Worcester Railroad Company until 1969, and in turn leased by the New Haven to the Connecticut Company; and the tenth line—the Suffield extending from Suffield to the Massachusetts state line—leased to the Hartford and Springfield Street Railway Company, now in the hands of a permanent receiver and operated under his control. This Company operates much more than the 4.70 miles of single track leased by it from the New Haven System, covering in addition 44.95 miles, serving Enfield, Somers, East Windsor, Ellington, South Windsor and Vernon, and on the western side not only Suffield over the leased line but also Windsor Locks and Windsor. Its northern and southern terminals are connected with loop lines of other street railway systems so that transportation between Hartford and Springfield may be continuous. The company is the successor of the Enfield and Longmeadow Electric Railway Company incorporated in Connecticut in 1903. In 1904 and 1906 it purchased the rights, property and franchises of three other street railway or traction companies and started on its conquering career.

Another street railroad which started to run freight cars by electricity from a connection with the New Haven system at Cedar Hill, New Haven across streets and over private way to the railroad and steamboat at

Belle Dock (steamboat wharf and Tomlinson's bridge) was acquired by the system in 1907. It is not now operating but during the present year an effort has been made to extend the tracks down the eastern shore for the benefit of incoming manufacturers. The company when incorporated was known as the Manufacturers' Street Railway Company.

When the Shore Line Electric Railway Company was incorporated by the legislature of Connecticut in 1905, a system of interurban transportation was outlined under which it became possible within a few years to operate trolley cars through from New Haven to New London along the shore without change and also for the further extension of this feature of pleasant travel from New York to Boston. The first part of the line was constructed from Guilford to Ivoryton in the town of Essex, cars being operated September 10, 1910. The same year the rails were extended to Stony Creek on the west where connection was made with the cars of the Connecticut Company running into New Haven. During the three succeeding years extensions were made from Guilford to the junction of State and Ferry streets in New Haven. The eastern line was extended from Ivoryton to Deep River (Saybrook) and Chester, while the construction of a short piece of track at the west end of the Connecticut River bridge made it possible to operate through cars from New Haven to New London. The electric street railways belonging to the Connecticut Company in the New London, Norwich, Willimantic and Putnam Divisions, were leased to the Shore Line Electric Railway Company for ninety-nine years from the first day of May, 1913. Later other railways were leased and then bought until at one time that which was

known as the Plant System had nine constituent companies in its ownership or control. The territory covered embraced Westerly in Rhode Island and in eastern Connecticut nearly all the important towns and villages in the counties of New London and Windham, with an excursion into South Coventry in Tolland County. The total book value of the road and equipment in 1919 was $7,278,645.64. The company at this time was running its cars regularly from its New Haven terminus at the corner of Meadow and West Water streets in New Haven and particularly in the summer time was doing a good business carrying its passengers and freight to and from the many summer resorts and residential places along Long Island Sound. But the difficulties of financing the enterprise induced the owners to sell their property used in the generation of electricity and October 1, 1919 on application of the estate of the then just deceased Morton F. Plant, who had been the chief promotor of the enterprise with his large capital, a receiver was appointed. Much of the track was abandoned and taken up; and all cars except a few in the eastern part of the state removed. In July, 1920 the Superior Court authorized the sale of about 50 miles of track from New Haven to Old Saybrook. In 1921 the road had 30 closed cars and 14 open passenger cars, three freight cars, a combination car, a work car, two snow plows and 12 cars of a miscellaneous order.

But the road is now in part in running order again under the ownership of a new company—The New Haven and Shore Line Railway Company, chartered in 1921. At first cars were run only from New Haven to Clinton, but shortly afterwards, that is October 27, 1923, they went through to Saybrook. The completion

of the road to that point in its rehabilitation was celebrated in Saybrook October 12, much after the old-fashioned manner of welcoming the completion of a steam railroad when that means of transportation was a novelty; the town was decorated, bands played, a banquet followed a parade and there was a dance at the hotel. The latest enterprise of the new company is the construction of a spur track from the main line at Madison to Hammonassett Beach, a favorite summer resort.

The Connecticut Company is the creature of the New York, New Haven and Hartford Railroad Company, chartered in 1905 as the Thomaston Tramway Company to build from Thomaston to the "village" of Waterbury; in 1907 its name was changed by the Superior Court to the present title; in 1909 it became possessed, by merger, of the powers of the Columbia Traction Company chartered to build a railway in Columbia and Mansfield and acquire property for the development of water power and the generation of electricity. Thus it became ready to start upon its wide-spread development plans. When the first report of the company was submitted to the Railroad Commissioners the only property the company owned was six miles of main track under construction from Thomaston to Waterville. This report was for the year ending June 30, 1907, covering only one month of its operation. But it had taken over under lease all the electric railways owned by the New York, New Haven and Hartford Railroad Company and was operating them. In 1909 the capital stock of the Connecticut Company was $275,000, all owned by the steam railroad company. February 28, 1910 these electric railways were sold to the

Connecticut Company, the capital stock of which was increased to its present altitude—$40,000,000—to meet the expense. Later this stock was placed in the possession of the New England Navigation Company, from which it was taken in 1914 by the United States District Court for the Southern District of New York upon a finding that this navigation company was a participant with the New York, New Haven and Hartford Railroad Company in a combination in restraint of trade. Federal trustees were appointed and have ever since been in charge. A sale was ordered but postponed from time to time because market conditions were unfavorable.

There are fifty-nine or more constituent companies in the collection.

The Connecticut Company operates one-man cars in all the cities of the State, although there is complaint about the danger attending their use. This opposition has been most largely voiced in Hartford because of the so-called Tucker Grant made to the old Hartford Railroad Company back in 1894, by the Court of Common Council when it gave the railroad power to install electricity. Councilman Tucker was the author of a substitute resolution by which the power was granted providing "That each electric car propelled alone on said tracks by said system and each train of more than one car, shall be provided with a conductor in addition to the person in charge of the management of the car or train." It was also provided that the directors should report to the city clerk each year the gross receipts of fares received other than on the East Hartford and Glastonbury line and "pay into the city treasury each year thereafter two per cent of its annual gross receipts

as evidenced by such reports." As finally amended by the Board of Aldermen the resolution provided "That the directors of the Hartford Street Railway Company shall report under oath to the City Clerk of the City of Hartford on or before the first day of February, 1896, for the preceding year ending January 1, 1896, and annually thereafter, the amount of the gross receipts of fares received within the city limits, and shall pay into the city treasury each year two per cent of its annual gross receipts of fares as evidenced by such reports, until such time as the state law shall be changed so as to provide that taxes of street railway companies shall be paid locally instead of to the state; and in case of such change in the law, the company shall pay annually to the city any deficiency in the amount of said taxes from the amount of said two per cent on the receipts aforesaid." This resolution as amended was adopted by the Court of Common Council March 19, 1894.

One-man cars were put on by the Connecticut Company, the successor of the Hartford Street Railway Company, in 1922, the city having given its permission in 1919 with a proviso that such cars should be discontinued upon six months' notice. The permission was extended May 9, 1921. It was "provided, however," in both resolutions "that this resolution shall never be construed to suspend said agreement known as the Tucker Grant in any other respect."

The trolley companies are interested in amusement properties particularly those at the shores which are so largely patronized in the summer time. The Connecticut Company has sold much of its holdings at Savin Rock near New Haven and is preparing to rid itself of those at Momauguin in East Haven, intending to devote

itself wholly to transportation. This determination points also to the sale of the famous Charles Island off Milford.

Velocipedes and Bicycles

For some thirty years, from 1870 to 1900 velocipedes, bicycles or tricycles were leading means of individual riding or transportation. The Draisine of German parentage, and the "Dandy Horse," born in England, were the precursers of the velocipede early in the 19th century. No one remembers seeing them in Connecticut. The person astride one of them used his feet on the ground as the propelling power and was very proud of his ability to cover ground, usually wearing a high hat while doing so. There were two wheels tandem as in our bicycle of today. In 1866 a Frenchman—Pierre Lallement—temporarily residing in New Haven, was the first person to apply cranks to a single track machine. All these machines had wooden wheels, some of the wooden bicycles surviving until the eighties when they were still seen on the streets of Hartford. Then came the idea that it were better to have one very high wheel in front and a very small one behind, this idea being developed into the so-called "Ordinary" operated by a crank on the front wheel. This was the first bicycle manufactured in this country and it was made in Hartford by The Pope Manufacturing Company, the successor of which company—The Westfield Manufacturing Company of Westfield, Massachusetts—is still making bicycles of the improved types which for years gave the Hartford company a world-wide reputation.

The cycling history of America originated in Hartford when Col. Albert A. Pope, founder of the Pope Manufacturing Company, built and introduced to the

public the "Columbia." This was in 1878, when after having imported from England the "Ordinary" bicycle for the previous two years, he conceived the idea of making them. He began the manufacture in the old Weed Sewing Machine Company factory, which he afterward bought. The drive of the "Ordinary" was entirely on the front wheel, cranks and pedals being fastened to the sprockets, no chains being used. The danger and difficulty of operating this machine led to a return to the two-wheel type, which in these later days was called the "Safety" bicycle and operated with chains and ball bearings. These machines had solid rubber tires. In 1889 came the pneumatic or inflated tire and about this time also the drop frame for ladies. The back pedal brake was then added. It is said that an express train was overtaken by a bicycle, for in those days there were many bicycle races that developed sturdy wheelmen. In 1888 Col. Pope had 500 employees in his works; in 1900 he is credited with 3,800. This industry became a great American institution and prior to its final reorganization was probably the leading industry of Hartford, occupying at that time what is now a part of the Pratt and Whitney Company's quarters. It is important to note that the bicycle industry in first applying pneumatic tires assisted in the development of the automobile and the airplane. As late as 1897 2,621 patents for velocipedes, including bicycles, were taken out in the United States.

The tricycle reached us about 1877 and a few years before, the bicycle with two large wheels side by side, the driver being in the middle.

Motor Vehicles

While steam carriages were tried on the roads of some countries even before the steam engine or locomotive came into existence, none of these "horseless carriages" as the first motor vehicles were called early in the nineties, is reported to have operated on the roads of Connecticut. When Daimler, the famous German, invented his motor, in 1884 the struggle really began, but it was left for America to develop the gas explosive engine, under which progress was certain and rapid. First came the steam auto—some of this type are still on the market—and concerning which—". . . although naming the steam automobile first because of its earlier genesis, it is not to be understood as representing at present the most popular type of motor carriage, although it bids fair to become so."—Byrn, "Progress of Invention, 1900." Even in 1680 Sir Isaac Newton proposed a steam carriage in which the propelling power was the reactionary discharge of a rearwardly directed jet of steam. In 1787 a Maryland patent was granted to Oliver Evans for the exclusive right to make steam road wagons. It is stated that Thomas Blanchard of Springfield, Massachusetts just across our border, in 1825 produced the first real American automobile "but" it is added "nobody wanted it." Somewhat different from the automobile feeling of today. Early in the nineties the Whitney steam car was made in Hartford and was seen on the streets there but it did not continue long. The Pope Manufacturing Company of Hartford was on the market in 1907 with the Columbia Electric Phaeton, a number of which were seen perambulating around our capital city, and the Lo-

comobile Company of America of Bridgeport was a pioneer in both steamers and electrics. Soon afterwards the Pope company sold out to a New Jersey concern and the Locomobile began the making of high-class gasoline machines.

The Duryeas of Springfield, Massachusetts, built the first gasoline automobile that would run, as is their claim, but there was no market for it; this was just prior to 1895. It is further asserted that the first bona-fide sale of a gasoline car was that of a Winton, and a little later in this narrative we will see how one of them made havoc with the quiet country people and cattle of Connecticut. It was in the spring and summer of 1896 that one of the famous circuses of the world (a native of Connecticut also) exhibited in its street processions as a wonder, a horseless carriage. Mr. E. P. Clapp of New Haven designed an open horseless carriage prior to 1896. It was made by Hoggson & Pettis of that city and tried out in the streets under the care of Frank D. Willis employed by that firm. "The Adams Express Company," Willis says, "wanted to get one of the cars and sent some of their experts from New York to attend the try-out. We went up on East Rock to prove the auto's climbing power, in which it was all that could have been expected. Then we drove to Milford. All went well, except that as we had no muffler, we could be heard for miles away. Of course there were some horse drivers who couldn't get out of the way fast enough, and some unattended horses, that had to be dealt with. I frequently had to get out and hold them until our wonderful car got out of the way. There is one thing I must not forget to state—we stopped for some gas on Elm street just opposite the present Yale

gym; and how much do you suppose we paid for it? Six cents a gallon and there was no tax either. And besides all this we had oil given us."

The first operation for any great distance of any gasoline machine seen in more than a few of the towns of Connecticut was that of a Winton operated by Mr. F. W. Manross of Forestville, who drove from his home town to Hartford in the fall of 1898 in fifty-five minutes. The distance was 18 miles. Then he drove from Forestville to the New Haven City Hall—32 miles in one hour and fifty-one minutes. His best continuous run without stopping for water or gasoline was 40 miles, the average running time being 15 miles per hour. Then he made other runs,—to Bridgeport and to New York, all of which were highly successful as he notes himself in The Automobile Magazine for March, 1901. Concerning the consternation he created he states:

"When the machine first appeared on the road horsemen evinced considerable timidity, but a little consideration and thoughtfulness soon brought confidence to driver and horses. It was noticed that thoroughbred animals paid little attention to their later rival, while plugs and farm horses became wildly excited and furnished many laughable incidents. On meeting children or ladies driving it was always the rule to stop the machine and lead the horse by if necessary. Once two ladies and several children incontinently jumped from their carriage and fled over the fence as I approached and stopped the machine, while the horse looked calmly on. The excuse for their action was: 'We were afraid he would run away.' It occurred to me they had given the animal a mighty good chance." While en route to Cheshire two men threw a blanket over the

head of their horse so as to hide him from the machine. While passing over the Hartford turnpike the machine frightened a farm horse so that he broke the traces from the plough and ran away.

Registration and Taxation

The rapid increase of the motor vehicle on the streets of Connecticut led to an early consideration of laws regulating their speed and imposing taxes to be devoted to the needed improvement of the highways which they were using. The tax on the automobile was direct, but that on the gasoline used was indirect because paid by the distributor after its receipt by him from the consumer. The Federal aid to this highway fund made road building one of the wonders of the century, recalling the roads the Romans built when they owned the world. In 1901 the first regulatory act was passed by the legislature of Connecticut; it affected the speed only. Then in 1903 an act was passed providing for registration and numbering. The first registration was with the Secretary of State. Richard J. Dwyer of Hartford, who was for many years connected with that office as Deputy Secretary, retiring in 1923, with plaudits of his countrymen for duties well done, had charge of the registration. He writes:

> The first law passed by the General Assembly relating to motor vehicles regulated the speed, which was not to be greater than fifteen miles an hour on highways outside cities, and twelve miles an hour in cities. This law was passed in 1901. In 1903 a law was passed providing for registration and numbering. By the provisions of this law no motor vehicle was to be operated on the public highways of the state after July 1, 1903, unless the owner thereof first filed with the Secretary of State a statement giving name and address together with a brief description of the car, and obtaining from

the Secretary a numbered certificate. It was further provided that the auto must have displayed on the back the initial letter of the state and the number of the certificate issued. Under this law the numbered plates were not provided by the state but could be purchased by the certificate holder from any enterprising dealer in auto supplies. The only limitation on the style and make was that the initial letter of the state and the certificate figures must be at least three inches high. The result was that there was quite a variety in the style of markers. Mr. Charles G. R. Vinal was Secretary at this time. Under this first registration act Mr. (now Judge) James P. Woodruff of Litchfield secured marker 1, which he has retained by legal renewals from year to year until this year—with the probability of holding it many years more.

In 1905 the General Assembly passed a law providing that the Secretary of State should furnish the markers, one pair to be furnished to the owner of each car. One marker was to be fastened upon the front of the car and the other upon the rear and so secured that they could not swing. The speed limit was changed so that no motor vehicle was to be operated in any city or borough at a greater speed than one mile in five minutes, and outside of these limits at a greater speed than one mile in three minutes.

In 1907 was passed the first law providing for taxation of automobiles and for the licensing of operators of the same. All operators had to procure from the Secretary a license to operate, said license continuing for one year, the fee for the same being $2. The registration fees under this law were as follows: Motor vehicles of less than 20 h. p. $3; between 20 and 30 h. p. $5; of 30 h. p. or more $10. The registration also continued in force one year. In 1909 the law was amended so as to provide more thoroughly for the safe-running of such vehicles and the punishment of reckless drivers; also for the administration of the law by the Secretary of State. Taxation was based on the horse-power of the machine and was made 60 cents per horse power. Since 1909 I recall no radical changes in the general features of the law except that at recent sessions of the General Assembly the fees for commercial autos have been very materially increased, with also an increase in the fees for pleasure autos.

The records of the very early days of the automobile registration have been destroyed so that nothing remains

to tell the story of numbers and receipts. The General Assembly of 1917 provided for the appointment of a Motor Vehicle Commission, and he took office June 1 that same year. In his first annual report he compared the receipts in 1912, before he held office, with those for 1918. For registrations of all classes these were, in 1912 $195,673.39; in 1918 $953,530.41; from licenses for operators in 1912 $52,482 and in 1918 $218,176. The total receipts for 1912 were $255,124.06 and for 1918 $1,285,164.27. The receipts for the year 1911 were also given in bulk as $230,120.89. These figures except those for 1918 were of course obtained from the Secretary of State. The Motor Vehicle Commissioner reported that for the year ending September 30, 1918, the number of operators of all classes licensed was 104,000. This included 2,542 motor cycle operators. The number for 1923 was 213,395. The registrations of cars by classes for the years 1923 and 1918 are:

	1923	1918
Total	188,632	94,114
Private (pleasure)	148,791	86,067
Commercial	29,140	
Dealers (automobile	928	357
Dealers (motor cycle)	85	3
Public Service	2,578	3,441
Jitneys	239	
Combination (pleasure and business)	2,051	......
Repairers	35	......
Trailers	218	......
Tractors, road	17	......
Motor cycles	2,820	4,246
Side cars	1,730	

The local taxation of automobiles is by towns and the Motor Vehicle Commissioner is required to transmit a

duplicate of the registration to the town clerk of the town in which the owner resides.

There were in 1923 299 kinds of pleasure cars and 246 kinds of trucks registered in the State. These included 65 of the old Pope-Hartford car, of which 26 were trucks. Among other varieties were two home-made pleasure cars and 39 home-made commercials. The number 1 car of Judge Woodruff of Litchfield is no longer the one-cylinder which had the honor of taking first place in 1901.

There is a car for every other family in the state and the smallest town in population, that is, Union, has the greatest proportionate number—one to every four of the population, or counting families as of five persons, a machine for each family in its 24 square miles.

The Jitney

The jitney began to disturb the street railway companies about the year 1915. The name of the ever present auto-bus or motor vehicle clamoring for passengers at every street corner and mid-block space is from an Americanism meaning a nickel or five cents, which was the original fare charged. There are few such cars now in existence, for jitneys have been defined by Connecticut law (see Chapter 77, Public Acts 1921) as "Any public service motor vehicle operated in whole or in part upon any street or highway in such a manner as to afford a means of transportation similar to that afforded by a street railway company, by indiscriminately receiving or discharging passengers; or running on a regular route, or over any portion thereof, or between fixed termini." And none may be authorized to operate until after a public hearing the Public Utilities Commis-

sion finds that "the public convenience and necessity require its operation over such route" as that requested. There are few if any five-cent fares and no stopping at many corners in the city. The travel is mostly interurban. There is no crowding behind the trolley car as in the old days when nearly every public vehicle in sight was a real jitney.

The city where the greatest competition between the jitney and the street railway seemed to exist was in Bridgeport, where there was a fierce contest with long and fiery hearings. The Commission denied the petitions of the jitneurs on the ground that although frequent jitney service might prove a temporary convenience it would ultimately result in the abandonment of a street railway with all the consequences of such abandonment upon future public convenience and necessity. In 1923 the matter came up again and the petitions of 59 jitney bus operators were again denied, the Commission holding that "If street railway service is to be continued in Bridgeport it will require the undivided, normal street railway patronage along and adjacent to its line of operation."

At the close of the fiscal year 1923, 239 jitneys were in operation, 152 of the bus type and 87 of the touring car type, altogether having a seating capacity of 3,164. Of the twenty cities in the state only four had local jitneys; and of the twenty-three boroughs only two were thus equipped. But the inter-urban busses leaving and arriving at certain fixed points as termini covered nine additional cities, seven more of the boroughs with also 31 towns and villages. It is impracticable to fix upon the number of places touched during the trips. This local bus service is also increased by the thirteen local

lines operated by the Connecticut Company to extend and improve its connections, and by the same company's two interurban lines, one of these running between New Haven and Bridgeport touching at intermediate points and the other between New Haven and North Branford. Interstate jitneys are also running.

Commercial Motor Vehicles

The commercial vehicle—that is, the "vehicle designed and used for the transportation of merchandise or freight, which is propelled or drawn by any power other than muscular, except such as run only on rails or tracks"—has entered largely into the transportation of short haul manufactured articles so as to meet with the serious opposition of the steam railroads, the trolley service with its express department, and the water carriers. The number of commercial vehicles registered in Connecticut during the calendar year 1923 was 29,140. Added to these freight carriers are a large number of out of state vehicles that do more or less of long distance traffic from other states, much of this freight being thus forwarded because of the lack of necessity of crating and of carriage to, and from terminals by truck. An official investigation shows that during the months from September 2 to December 3, 1923, the total net tonnage of freight carried by motor trucks along the highways of Connecticut was 1,019,688. It is known that the peak of the traffic is in October and the minimum in February. If the three months' record as given be taken as an indication of the yearly freight traffic by motor truck the annual transportation would reach a little over four millions of tons. The tonnage of freight carried by the trolleys is not forthcoming for comment

but the steam freight traffic during 1922 was a tonnage of 33,845,649. This was increased by several millions in 1923.

The Motor Cycle

The number of motor cycles registered in 1923 was 4,550, including 1,730 side cars, and the number is increasing from year to year notwithstanding the increase in the number of cheap used cars for sale. The side car attachment and the package car keep up in popularity also. The first motor cycle seen in Connecticut was practically a bicycle with an engine attached; it has become a lordly carriage now having in some cases a top and storm front and booming along the city streets and country roads with its often-time open muffler. It recovers its speed and gets over the ground much faster than the ordinary automobile. Motor cycles are really miniature automobiles weighing about 400 pounds and travelling over all kinds of bad roads at a speed that would seriously endanger any ordinary automobile. The motor cycle did not come into use in Connecticut until the late Eighties, having been first developed in Germany about 1884.

Fire and Police Transportation

The municipal motor vehicles do not have to contribute to the State treasury for registration fees or drivers' licenses. The number of municipal registrations for the fiscal year ending June 30, 1924 was 1,173 and of municipal operators 335, so it is safe to assume that all our fire and police departments are fully equipped with the latest devices. Hartford took the initiative back in 1876 with a steam-propelled fire engine, one of the first in this country. Fire Chief Moran

writes: "Old No. 4 was placed in commission in 1879, 'Jumbo' in 1889 and new No. 4 in 1901. The engine purchased in 1876 and the one purchased in 1879, both smaller than 'Jumbo,' were discarded several years ago. 'Jumbo' had a gasoline electric tractor installed two years ago and No. 4 is still operated with steam power. These engines were first operated in New York and Boston and, I believe, one in Troy about 1874. They were operated in those cities but a few years only; were then dismantled and drawn by horses. The one in Troy was purchased by Hartford in 1879. This department has operated steam-propelled fire engines continuously for forty-eight years and during that time they have given excellent service although now they have to give way to the more modern fire apparatus. The new No. 4, which is still being operated by steam, has a greater pumping capacity than the better known 'Jumbo' engine. This will probably be replaced by a large-capacity gasoline pumping engine in the near future."

In New Haven the gasoline-driven apparatus came into use about 1911 and in the various other cities a little later. The police wagons and ambulances were also taken on in this upward movement until all municipal classes are now supplied with the latest in transportation vehicles.

Vehicles of the Air

Connecticut was the first among the states to provide for the registration of the airplane and the licensing of the operators. Governor Simeon E. Baldwin, when he took office in 1911, called attention to the new method of transportation and recommended the passage of a statute providing for the registry of operators in the office of the town clerk in each town in which aeroplanes

or dirigible balloons are owned. In accordance with this recommendation the General Assembly at its session of 1911 adopted the first act in the United States to control aircraft. The application for registration was to be made to the Secretary of State. No license could be issued to any person under the age of 21. This law was soon after changed so that the Commissioner of Motor Vehicles was made the licensing medium. In his first report after taking office in 1917 which report was for the fifteen months ending January 1, 1919, he wrote: "It is projected that the most available flying fields in the state be chartered so that whenever an airplane alights in Connecticut the State Police Department will forthwith have notice by wire of the fact that such a plane is in the state and then, through the agency of the police, the aviator can be prevented from again flying until he is examined and qualified." In his report for 1922 he stated that the number of aircraft in the state probably never exceeded twelve in all, and announced the appointment of a qualified aviator of large experience to inspect planes and aviators.

Only four airships were registered in 1923, but this was increased to 12 for the first half year of 1924 and there are only two active improved airports, airdromes, or fields—Brainard at Hartford and the Harris Whittemore, Jr., at Bethany. The Brainard Field has an extent of 90 acres owned by the City of Hartford. The second annual aviation meet was held there in 1922, and many flying stunts have taken place. What is of more importance, the Army Airship D-3 completed a flight from Aberdeen Proving Grounds, Maryland to Hartford and return November 10, 1922, and a Newark, N. J. company advertises inter-city flights between New

York and Hartford. The Hartford field has facilities for both land and sea planes. It has an 1,800-foot runway east and west and a 3,200-foot runway north and south, and two hangars.

The Bethany field is under the management of the Colonial Air Lines, Inc., with post office address at Westville, which is a part of New Haven. Secretary Stilley writes that the equipment of the airdrome consists of two Curtiss biplanes, one J. F. N. biplane and one Fokker biplane, the last being considered as modern a piece of air transportation equipment as any yet manufactured. It is adapted to long range high-speed flights and has a carrying capacity of three individuals and may be flown under any condition of weather. Its cruising speed is about 125 miles an hour with a maximum of about 150 miles. The flyers at Bethany have made Chicago in seven and a half hours. The Curtiss planes are used for short range flights with a radius of 200 miles. The Bethany field is about six miles south of Naugatuck and nine miles slightly west of north from New Haven. It contains 48 acres, has a runway north and south averaging 1,500 feet and one east and west of 1,400 feet, with a hangar at the northern corner of the field.

Bridgeport has a municipal field three miles from the city on the Long Island Sound. In addition there are twelve emergency fields located at Branford, Bristol, Danbury, Meriden, Middletown, New London, Pawcatuck, Plainville, Putnam, Stamford, Waterbury and Willimantic.

A New York city corporation operated in 1922 between Port Washington, L. I., and New London, making sixteen flights and carrying 128 passengers. A

New Jersey corporation, which does not operate its air vehicles for pay, carried 6,000 pounds of freight in 1922, having Sachem's Head for one of its landing places.

In April, 1924, Governor Templeton sent a letter to 19 cities in the state asking the mayors to establish proper landing places for airships as a part of any scheme of municipal development and Mayor Stevens calls Hartford's attention anew to the importance of Brainard Field upon which two hangars have been built by the state and national governments, the state having established an air squadron which, aided by the general government, makes its headquarters there. It is also hoped that the government will make Hartford one of its landing places for the air mail service. The Bethany Field has also turned its attention to the mail service and would like to conserve the interests of all New England, furnishing the planes, the official landing place remaining in Hartford. Hartford is also providing an airplane hangar for public use.

New Haven and other cities have Air Boards or Aviation Commissioners and strong efforts are being made to furnish and improve airports and landings with a view to regular lines of communication especially of the mail service which is now being so satisfactorily conducted between New York, Chicago and the Pacific Coast. The New Haven Air Field, Inc., has secured a large tract of land on the west side of Quinniapiac avenue to be used as a flying field and landing place and has provided a two-passenger Curtiss plane. The Pride Aero corporation has leased ground in Woodmont in the town of Milford where it will lay out a field and provide planes for use in the commercial field.

The publishers acknowledge with great thanks their indebtedness to the following by whose generosity the publication of this work has been made possible:

Homer S. Cummings
J. Henry Roraback
Frank C. Sumner
Benedict M. Holden
Charles M. Beach
Sarah E. Bristol
Fred Atwater
George P. McLean
John B. Byrne
Alfred C. Fuller
Rollin S. Woodruff
David E. Fitzgerald
J. Vance
Marcus H. Holcomb
John T. King
John H. Trumbull
Samuel O. Prentice
Hiram Bingham
Henry Roberts
Earnest E. Rogers
John M. Wadhams
Charles T. Treadway
L. P. Waldo Marvin
Charles E. Gross
Frank B. Weeks
F. William Behrens
Matthew H. Kenealy
Francis P. Guilfoile
John A. Cornell
James J. Walsh
Charles Phelps
C. Denison Talcott
Edwin S. Thomas
William R. Burnham
Charles D. Lockwood
Hormisdas Dion
Alexander L. DeLaney
Edward T. Buckingham
John J. Phelan
Thomas E. Cahill
James H. Pratt
Daniel Davenport
Charles B. Waller
Clarence G. Willard
John L. Gilson
Charles M. Bakewell
John L. Purcell
M. C. Manternach
Archibald A. Welch
Louis R. Cheney
Leo J. Noonan
Francis P. Garvan
Charlotte W. Rice
H. Wales Lines
Thomas F. Goode
Seth L. Pierrepont
Frank M. Chapin
William G. Park
Edward T. Carrington
Charles F. Brooker
John A. Coe
Harris Whittemore
Solomon Elsner
William E. Egan
Franklin Farrell
Charles H. Nettleton
Lucius S. Storrs
James P. Glynn
Schuyler Merritt
Jennie F. Coe
Frank B. Munn
Clarence Whitney
James A. Farrell
Edward J. Pearson
Arthur D. Coffin
Fred S. Chase

Dr. Edward G. Dolan
Julian W. Curtiss
Samuel Russell, Jr.
George B. Alvord
Charles G. Morris
R. Leland Keeney
Frederick C. Walcott
John H. Cassidy
Louis E. Stoddard
The Yale & Towne Manufacturing Company
Waldo C. Bryant
Justus J. Fennel
William H. Putnam
Charles H. Remington
J. Windsor Farist